PAVING AND MUNICIPAL ENGINEERING

A Journal Devoted Specially to Street and Sidewalk Paving, Sewerage, Water-Works Construction, Street Lighting, and all Matters Pertaining to Municipal Engineering.

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Communications are invited, and all requests for special information on the subjects treated by this journal will receive careful attention.

Articles relating to the different branches of municipal engineering are desired. Stamps should accompany manuscripts for return postage if unavailable.

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The columns of this publication are open to the discussion of all subjects relating to paving, sewerage, water-works, street-lighting, and the physical improvement of cities. Practical information as to the merits of materials used in such work and new methods, with photographs and drawings, which may be used for illustration, are especially desired. We are glad to get brief notes as to proposed improvements and the letting of large contracts.

City engineers are requested to send us as early as possible copies of their annual reports, which will be given proper notice.

Articles relating to methods of road making and maintenance are invited.

DOMESTIC LIGHTING AND HEATING OF CITIES AND TOWNS.—II.

By William Waplington.

FROM what has been already adduced,* and from further considerations of the subject, we can not set aside the association of light and heat, consequently we are constrained to admit that combustion plays an indispensable part, no matter how indirect the process of producing light may be.

Combustion—according to our present knowledge of the phenomena—is the starting-point of artificial light, and probably solar light, too. Confining ourselves, however, to artificial light, except where the analogy of solar light may assist us, we find it to be an effect of combustion. And what is combustion? Simply the combining of oxygen with some other body; it may be another gas—hydrogen, for instance, or it may be some metallic body, as magnesium. This metal gives out a brilliant and intense light by direct combustion in atmospheric air, combing, of course, with the oxygen of the air only, the result being oxide of magnesium; heat is required to set this combustion into active operation; the combustion of other substances is nothing more than their oxidation, and upon the rapidity of these oxidations depends the intensity of the heat, and, concurrently, the light produced.

In my first paper—referred to above—I mentioned carbon as the pre-eminently fitting element for lighting purposes; in passing I may say heating purposes, too. It has the advantages of cheapness and an almost unlimited supply; it also has the merit of great thermal capacity and unchangeableness of physical state by temperature alone, hence its superlative fitness for the points of the arc light. This light, for intensity is highly satisfactory for the present age, and so was the advent of gas and parafine oil a few years ago, and of course the arc light would appear by comparison nearly perfection; still I have what appears to me good reason to think we shall have in the near future as perfect a light produced with one-fourth of the energy expended in the arc light. This expenditure of energy is a serious drawback to the progress of electric lighting and heating. It must, however, be admitted that to-day it far outdistances all rivals in brilliancy and power. The possibility of concentrating energy at a much less cost opens up a wide field for inquiry.

The reproduction of solar light and heat are by no means perfect yet, and researches into the chemistry of these two states of matter—light and heat—are unfolding daily new processes for their development. Perhaps the grandest leap in the *science* of heat production was made about forty years ago with the regenerative furnaces of the late Sir William Siemens and his brother Frederick. This furnace is sometimes erroneously called a Siemens-Martin furnace. The mistake arises from confounding the furnace with a process of steel-making in which the Siemens furnace was a necessity to the success of the process; the *process*, therefore, was called the *Siemens-Martin process*, but the invention of the furnace belongs exclusively to the Siemens brothers. I offer this correction because I so frequently hear this furnace spoken of as a Siemens-Martin, and I often read of it as such in high-class journals and newspapers, which always impresses me with the sense of an injustice done to the Siemens brothers. The world is much indebted to these two gentlemen for their discoveries in the propagation of high temperatures and their economical application to the manufacturing industries. This is the furnace mentioned in the first part of this paper* where the intense heat gives out light of such dazzling brightness.

A medium-sized furnace of this description contains a flame which, if used for lighting instead of melting or heating, would equal 1,800 lamps of 200 candle power each, and I really think much more. This immense quantity of intense light is maintained at a cost of less than $12 per twenty-four hours; thus, for fuel, $8, and labor $3 50; this is at the rate of two-thirds of a cent for each 200 candle power lamp per twenty-four hours. I mention this to show the practicability of making and supporting one immense

*See PAVING AND MUNICIPAL ENGINEERING for May, 1892.

flame equal to the 1,800 lamps mentioned. The distribution of this mass of light would no doubt run up the cost of its maintenance, but there appears a good margin to work on and many methods open for experimenters. Leaving this now as food for reflection and for the exercise of ingenuity, let us consider the subject of domestic heating.

The furnace I have just referred to was in no sense designed for the production of light, but for intense heat and economy of fuel in the generation of such intense heat, and those who are familiar with this regenerative system need not be told that it is both practical and easy. The high temperature available is only limited by the fusibility of the materials of which the furnace is built.

Such furnace temperatures were unknown until the advent of the Siemens regenerative furnace, and with this sprang up a demand for more refractory fire-bricks, fire-clays, etc., good Stourbridge (England) fire-bricks were entirely useless in the roof, ports, jambs, and bridges of this furnace; even the best Denas silica bricks are easily melted by this quiet, but powerful heat. The writer has frequently seen these bricks trickling from the roofs of steel melting furnaces as thin in fluity as molasses; the infusible silica actually "melting with fervent heat." This intense heat is confined in a space of about 400 cubic feet to 500 cubic feet then entering regenerative chambers built at each end of the furnace, the temperature gradually declines until reaching the smoke stack it ascends, reduced to about 300° F. The heat may be graphically represented by the crescendo and diminuendo marks in music thus <> where the middle of the swell would be the furnace and the pointed ends the bottom of the regenerative chambers.

Such high temperatures, however, are only required for melting substances that are classed as infusible; domestic heating does not call for anything near so high, nor is it needed in such bulky parcels. There are, however, many points for consideration besides supplying a certain amount of heat in a given time. In winter we must maintain and distribute it pretty evenly over all the rooms in the dwelling, while in summer a concentrated heat, for short intervals only, is required. The oil and gas stove meet this requirement admirably, but is somewhat costly for the time it is used.

While living in Peoria, Ill., from 1886 until 1889, I became acquainted with Major G. W. Weightman, city engineer of that city, and we had a plan in embryo which never got beyond the "talking over" stage of development, which nevertheless had some promise in it. We proposed, by way of experiment, to erect a suitable fuel gas producer in the center of a city block, and to have a gas main running to each of the four sides of the block, these to connect with a second main running all round the inside of the block, and from this endless main branches leading to each house suitably connected and fitted up for all domestic purposes. By this system, two men, one on each shift, could do all the stoking for the whole block, thus relieving each patron of the trouble and inconvenience of laying in a winter's stock of coal, to say nothing of the coal dust, ashes, dirt, etc., being concentrated at the gas producer. The most attractive feature, however, of this system, is the incomparably low cost of the gas.

The Peoria Gas-Light and Coke Co. had at the time mentioned above an excellent proviso for their customers who chose to use their gas for heating purposes; they would put in an additional meter and charge half price only for the gas consumed in stoves, furnaces, etc., but even with this liberal reduction, heating gas cost $1 per 1,000 feet. Now by the system mentioned above—after making liberal allowance for interest on cost of plant, depreciation, wages and purchasing a fair quality of coal for gas making, the gas would not cost more than 2½ cents per 1,000 feet in Peoria. This may appear a very preposterous statement to some who are accustomed to the statement that "one ton of good gas coal will furnish about 10,000 feet of gas. I would remind such that the residue—coke—which is drawn from the retorts of gas works, is, by the fuel gas producers, converted into an excellent heating gas—carbon monoxide—which is practically as high in thermal units, measure for measure, as hydrogen. My friend, Major Weightman—mentioned above—went several times to see this system of producing cheap fuel gas at the Peoria Pottery and at the Peoria Grape Sugar Company's works. This latter establishment has it applied to eight tubular boilers, aggregating 660 horse power, besides having about half a dozen bone-kilns operated by it.

Where several producers are run in conjunction with each other, the gas is produced at a much cheaper rate. The Grape Sugar Company often made over 6,000,000 cubic feet in 24 hours at a cost of about 1½ cents per 1,000 feet. One of the most important points in making this gas so cheap is the *immediate* consumption of it as close as convenient to the producers; by this means the initial heat is nearly all saved and there is no outlay for holders or storage rooms. Many novel plans have at different times been proposed for the distribution of fuel gas. The late Sir C. W. Siemens at one time entertained the notion of converting the coal into gas in the mine and allowing it to ascend the shaft by its specific gravity, thence to be sent through mains to where it was needed. By this method, he said, raising solid fuel from the mines would cease, as would also its transportation by rail; moreover, the incombustible matter—ashes, clinkers, etc.—in the coal could be stowed away in the "graf," or old worked out chambers; thus, nothing be sent out of the mine but gaseous matter.

Now, at first sight this may appear to some—as it did to me—quite feasible and full of promise, but, it has its drawbacks.

Another big scheme was proposed in 1889 by a well known syndicate in one of our western cities; they proposed buying a large tract of coal-land near the city and operate coal mines in connection with extensive gas-producing plants at the mines, with suitable underground mains laid to the city and branches laid off to the large factories, etc. The gas would be forced through these mains, branches, etc., by suitable engines at the works. The object of this scheme was to save railroad freight charges and to use up *all* the coal that was mined, because at that time the very wasteful custom prevailed, of loading the coal in the mines with wide pronged forks which would allow all that was smaller than a hen's egg to fall through, and this was all cast aside to remain in the mines. This—like the proposition of Sir W. Siemens—appeared feasible enough, but a practical trial on a small scale upset all their mis-calculations, and was another verification of those axiomatic lines of Burns, "The best laid schemes o' mice and men, gang aft a-gley," etc.

These few hints and scraps of experience may set moving a train of thought that will eventually develop a cheap and practical system of lighting and heating cities and towns. The field is a large one and scarcely touched yet, and I think it is more in the province of municipal engineers than any other profession. There are some really clever, good, and earnest men amongst them, and fame, if not fortune, awaits the individual who solves the problem of commanding and controlling the energy stored up in a lump of coal.

A TRAVELER'S OBSERVATIONS OF STREETS AND ROADS IN MANY COUNTRIES.

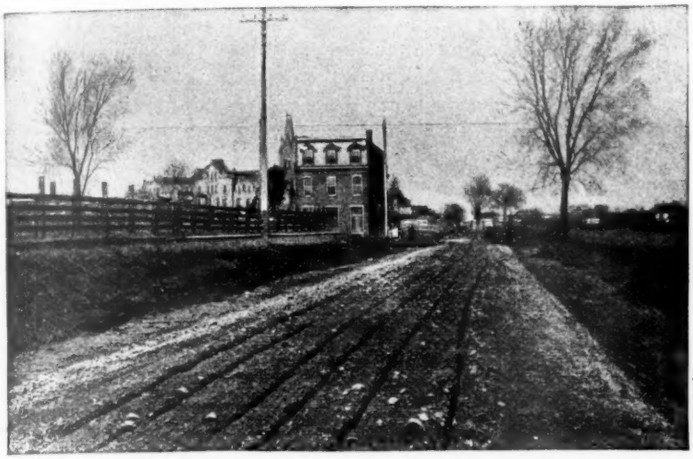
By W. Lodia.

AS the result of much travel about the globe, I would like to contribute something to PAVING AND MUNICIPAL ENGINEERING anent that most important matter for business people interested in conveyances of all kinds, whether for the transport of themselves over the public thoroughfares, or for the transport of their belongings. I refer to good roadways.

In Switzerland and Italy, the country roads are as well kept up as in Gaul. In Italian cities—at least, in great villas such as Geneva, Milano, and Torino, there is no curb to define the sidewalk from the road. The footpath is on a level with the street, and, when vehicles want to approach or stop temporarily before a doorway, they are driven clear on to the pavement, and passers-by have to look out. The commercial laws allow this. The custom has its advant-

ages; "blocks" in traffic which might otherwise occur are avoided by utilizing the foot-ways for the passage of conveyances.

On the French highways, the repairers literally pass their lives on the roads. Attached to their steam-rollers is a *fourgon* or coach as large as a railway guard's van. There are two bed chambers therein and a kitchen where they can do their own cooking. Thus, when repairing on the lonely country roads, remote from



town or village, they have not to go miles in search of food or a bed. These necessities they have handily near by. When working they leave the wagon at a convenient distance. It is invaluable as a shelter when a heavy storm comes on. It is altogether a comfortable little home for driver and fireman. But at night they are occasionally disturbed in their slumber by the thumping of the belated unfortunate outcast tramp, who would like to get in also. Experience has taught the occupants that the best way to treat the troublous vagrant is to pretend not to hear him.

The worst piece of highway road I ever saw was in France in the neighborhood of the town of Chateauroux. Hundreds of miles on either side of this mire road there is the best and hardest gravel road in the world, but at this particular place near Chateauroux, the road suddenly becomes, in going down hill, a frightful clay ditch. It continues thus for about 200 yards. A diagnosis was made of this peculiarity and it was found that the part of the route in question, formerly good, had in recent years had a spring burst on or near it, which could not be stayed. Then, as there was probably a parish boundary dispute just there, neither commune would agree to pay the expense for remedying the evil, so the traffic was forced to make one for itself by a detour.

And the best piece of road the writer ever saw (also in France) was at the town of Louillac, a villa of central southern Gaul, formerly noted for its excellent red wine, but its celebrity is now gone, owing to the declining temperature in France, and the consequent loss of the sun-power so essential to the production of good vintage. Well, at Louillac, in the middle of the town, the sandy road has become as hard as a rock (but there is no rock there), and as smooth as skating-rink asphalt. It is surprising. The nearest approach elsewhere to it in a foreign country will be found in the good old English roads about Gerrard Cross, Buckinghamshire.

The worst roads—in cities—which I have seen have been those at Buenos-Ayres and at New York. But in 1887-'88, the streets in the capital of Argentine have been greatly improved, while those of New York were, in 1889 (year of leaving the northern city), still in the most deplorable condition. It is surprising that such conditions should exist in a commercial center like New York. It shows scandalous municipal neglect.

The roads and streets of Paris are, from the historical point of view, the most interesting of any city in the world. What consumingly absorbing reading might be put into a short history of the principal thoroughfares of the great, gay city of three millions of inhabitants!

The writer was indebted for his early information on roads, and for what caused him to take an extended interest in their making and maintenance, to the works of one J. King, of (or formerly was at) 50 Booksellers' row, London. This noted technical writer's book, "Roads and Road-making," has always been found reliable. He took so much interest, in fact, in roads, that eighteen years ago we find King establishing a weekly journal entitled *The Road*, the first number of which appeared in 1874. The general public, however, care nothing about the technics of road engineering, so King's *Road* has only been published at irregular intervals since, so as to preserve the title, and give a synopsis of road events past.

Brick roads there are in respectable number on the steep ascents about Monte-Carlo and Monaco. They assure a firm footing where flag-stones would not, and heavily-laden mules mount and descend without ever slipping. These narrow brick roads of the little gambling state keep themselves very clean, little personal attention being required.

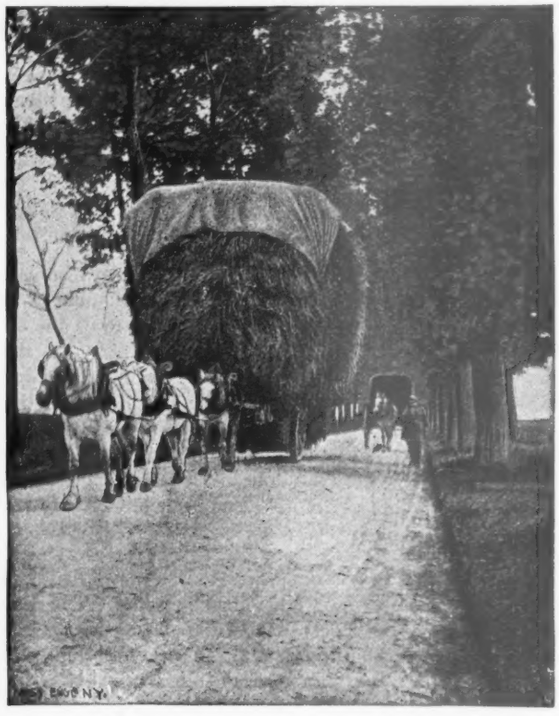
A continentalist once told me how he successfully made a good permanent way over a very bad bit of marshy ground. Tons of stone had been thrown thereon, but (as was natural) the stones always sank down and the mud always came up. At last the informant conceived an idea. He was at the time clearing away the furze from a common. Instead of burning this, he had it tied up into fagots, which were laid compactly over the marshy spot. They were weighted down with heavy stones, and then covered by a plentiful layer of smaller ones, followed by one of gravel. That road never gave trouble any more. The furze allowed of first-rate drainage.

The national highway from Paris to Orleans is firmly maintained throughout almost by well-laid cobblestones. The distance is about seventy miles. There are two tracks for nearly the entire length. The left hand (going toward Orleans) is laid with the big cobblestones in question, the right side is the ordinary hard gravel track. Each track of road is about 3½ meters wide, the average total width of the highway being near 25 or 26 feet, the two foot-walks on either side not included.

This seventy-mile, cobble-stoned, paved highway is believed to represent the most extensive piece of road engineering of its kind in existence. The writer has covered the entire distance over the road on foot, occupying three short days over the tramp. Even more. Those seventy miles were but the preliminary part of an immediately continued eight hundred mile walk right through France and into Spain via central Pyrenees. The journey of 1,300 kilometers from Paris to Barcelona occupied—by the circuitous route followed—thirty-six days, of which eight were spent in sight-seeing in the towns passed through and in resting.

Why the double track on the Paris-Orleans road? may be asked. It is for a good purpose. In wet weather, vehicles get on to the cobble-stones, and thus get over the road quicker and with less pull, though with more shaking.

As an extensive traveler, the question has been put me, Which cities of the world have the best roads and streets? Well, I think that the London city thoroughfares, with their asphalt, the best existing, being even superior to Paris. But London streets are in general not kept nearly so clean as streets in the French capital. In Italy's chief seaport town of Genova the streets are most substantially paved with huge and quite even flags, and will apparently last until



the crack of doom. The police constables there, as in some other Italian cities, are dressed just like gentlemen—high silk hat, long frock coat (all in black), and provided with walking-stick. In fact, the stranger is liable at first to take them for easy-going citizen-gentlemen, but in his walks the visitor will see a lot more, and all so dressed exactly alike, that he begins to think they must belong to some order His calculation will soon lead him on to the right theory—that these gentlemanly-dressed persons are the municipal police constables.

In Spanish cities there are usually good thoroughfares. At Barcelona (Iberia's chief commercial city), for example, the wood pavements are very satisfactory. Part of these are made of wood blocks, part of petty round pieces of wood, about 4 inches long, being branches sawn up. The work of laying these requires much handling and occupies much time, and is believed to be an economic loss. Still, being of oak, they are considered worth this trouble on account of their durability.

But Spanish country "roads" Save the mark and name! There are a few modern possible ones, but of the majority the less said the better.

Geneva, July 20, 1892.

TRINIDAD LAKE AND LAND ASPHALT.

To the Editor of Paving and Municipal Engineering:

SIR—I found in the last issue of your valuable journal an article titled "Street Paving in New York City," by Stevenson Towle, Consulting Engineer Department of Public Works. It was taken from the report of New York Department of Public Works, 1892.

As this article is not in accord with my statements, made in former issues of your paper, I beg to be permitted to occupy some space in your journal. I will devote myself exclusively to that portion of the report pertaining to asphalt and asphalt pavements.

The report states that careful examinations of the asphalt pavements have been made of both kinds laid, Sicilian Rock and Trinidad. A number of streets are mentioned which had been examined, but some have been overlooked; for instance, Wall street and Chambers street—I mean the relaying of the last street in 1891 with lake asphalt. A close inspection of both of these streets might have changed the final conclusions of the report, and as the work was done after the advent of the present administration, the inspection would have been in order.

The report further states that "Sicilian pavement was found to be thinner in the center of the carriage way than towards the gutter, and to a lesser extent the same condition was observed in the Trinidad pavement. In both cases this diminution in thickness is due to compression caused by the greater amount of traffic on the center portion of the street." This is all correct, but immediately under it we find in the report, "The Sicilian pavement does not attain its ultimate compression until it has been subjected to actual traffic for several months or longer, while the Trinidad pavement attains its final compression as soon as laid." The last will be news to all the Trinidad asphalt companies, and I am led to believe that it was not meant to express what it does, because it contradicts the former statement just as much as the one following: "The Sicilian asphalt compressed more than the Trinidad."

The report then tells us about the two different kinds of Trinidad asphalts and says: "The failure of a portion of the Eighth avenue pavement, laid in the fall of 1890, was due to the use of asphalt from the village plots of La Brea, on the Island of Trinidad, instead of from the Pitch-lake." Have not many failures been made with Pitch-lake asphalt? How, then, is it possible for Mr. Towle to come to such conclusion, when he himself says, in his report, that "the asphalt had been analyzed and approved by chemical experts." And further on, "The comparative failure of this pavement was exceptional, *and as chemists and experts were unable to account for it*, it was decided to lay no more pavement of this character until the cause of the comparative failure was determined." Nothing can be said against the last decision, on the ground expressed, but the assumption that the failure was due to the use of asphalt from the village plots of La Brea is entirely unjust, after chemists and experts had declared they were unable to account for it.

The description of a visit to Trinidad, which we find further on in the report, is very interesting but I do not believe that the trip has benefited the writer of the report any regarding his knowledge of refined asphalt. Special stress is laid on it that the asphalt known to American dealers in asphalt by the name of "overflow pitch," is called by the inhabitants and geologists (only a very few of the latter—*Sch.*) iron and land pitch.

Let us see what the chemists in the report say, Messrs. Ricketts and Banks, in regard to the character of the mineral matter found in all of the nine samples submitted to them: "The character of the mineral matter consists chiefly of silica, alumina, oxide of iron and lime." This character is alike in lake or land pitch, so that iron is contained in both, and is not a characteristic feature of either, therefore the name iron pitch does not signify anything.

In following the report further, we find the opinion expressed that lake pitch is considered superior to land pitch because in its crude state the former flows faster than the latter. The same argument has been used by a professor of chemistry, and photographs have been exhibited by him showing the pile of lake asphalt flattened out under the rays of the tropical sun, while the pile of land asphalt nearly kept its shape. I think science is outraged by such arguments, coming from a scientific man. So far as I know, nobody has disputed that the lake asphalt, in its crude state, contains more volatile oils than the crude land asphalt, but in the process of refining all these volatile oils pass off, and if the process of refining is correctly done, both asphalts reach a state of equality, which is justly claimed by the importers and refiners of the land asphalt.

Everybody would consider it folly to judge the whiteness and sweetness of refined sugar by a chemical analysis of the brown, from which it was refined, or to judge the clearness and illuminating power of the refined oil, by an analysis of the crude, green, natural oil. Why is it not just as much foolishness to judge the refined asphalt by a chemical analysis of the crude material? The changes the asphalt undergoes in the refining are almost as great as those in sugar and oil. The refined asphalts will not be precisely the same, because different refineries will produce different products, just as much as different sugar refineries turn out different grades of sugar and different oil refineries will yield different illuminating oils, even when the oils were taken from the same crude oil tank. I am firmly convinced, that in the wrong method of refining the failure on Eighth avenue must be looked for. Asphalt, continuously agitated with air, during the process of refining, must become brittle, and the use of such asphalts for paving purposes must bring about failures, as above mentioned.

The analyses of Ricketts & Banks amount to nothing and the deductions made from it are completely offset by the analyses of an authority, which no one will dispute:

REPORT ON VARIOUS SAMPLES OF ASPHALT TAKEN AT LA BREA.

I specially visited La Brea on the 16th ultimo, at the request of E. W. Packard, Esq., for the purpose of having the samples referred to in the accompanying certificate of analysis taken in my presence, and to satisfy myself of their authenticity. Nos. 1 and 2 were taken from two different parts of the lake; of the remaining samples some were taken from deposits now being worked near the lake, some from deposits near the sea, and some from deposits intermediate of these extreme points; so that the above series of samples may be fairly regarded as representative of the whole of the present working deposits in the district.

From the accompanying results of analysis it will be seen, that the samples are so similar in composition that for all practical purposes they may be considered identical in quality, and equally suitable for the manufacture of paving material.

The composition of the ash shows that all these samples have had a common origin; for the presence of mineral matter in these asphalts can not under any circumstances be regarded as adventitious, since it is thoroughly incorporated with the bitumen in the same proportion and has the same percentage composition, as regards the relative proportions of matter soluble in water, in acids, and insoluble substances, whether the samples be taken from the softest part of the lake itself, or from any of the present sources of La Brea asphalt.

From a personal knowledge of the local circumstances, the elevated portion of the lake itself and the comparatively lower levels of the other adjacent deposits, and from a careful study of the natural movement of pitch, I am of opinion, that the pitch found in the beds outside the lake has been derived from the lake itself by the subterranean flow of the pitch in the viscous condition, a condition which it readily assumes under the combined influences of heat and pressure.

(Signed) P. CARMODY, *F. I. C. and F. C. S.*,
Government Laboratory.

Port of Spain, Trinidad, May 4, 1892.

Consulate of the United States of America.

TRINIDAD, W. I., May 5, 1892.

Personally appeared P. Carmody, Fellow of the Institute of Chemistry and Fellow of the Chemical Society, personally known to me to be the Government Analyst at this place, who acknowledged the foregoing report, to which his signature is attached, as his voluntary act and deed.

Given under my hand and the seal of this Consulate the day and year hereof.

(Signed) WM. P. PIERCE,
[CONSUL'S SEAL.] *U. S. Consul.*

CERTIFICATE OF ANALYSIS.

I hereby certify that the samples of asphalt taken in my presence on the 16th ultimo from the lake and district of La Brea have been analyzed by me with the following results:

No.	Water.	ASH.				Loss on ignition bitumen.	Percentage composition of dry asphalt.		
		Soluble in Water.	Soluble in acids.	Insoluble.	Total.		Ash.	Loss on ignition.	
								Bitumen.	Other than bitumen.
1	21.40	0.93	4.44	24.26	29.68	48.92	37.76	53.46	8.78
2	27.38	0.90	4.04	22.44	27.38	45.24	37.70	55.42	6.88
3	26.46	0.78	4.04	22.88	27.70	45.84	37.66	53.78	8.56
4	26.46	Not	deter	mined.	27.76	45.78	37.75	51.46	10.79
5	29.90	0.48	4.70	21.50	26.68	43.42	38.06	51.36	10.58
6	26.42	Not	deter	mined.	29.40	44.18	39 96	53.07	6.97
7	26.36	0.62	3.84	23.70	28.16	45.48	38.24	52.11	9.65

Note.—Samples Nos. 1 and 2 were taken from different parts of the lake; the remaining samples were taken from deposits now being worked outside the lake. No. 1 is taken from the center of the lake and is a soft pitch—locally termed liquid pitch. No. 2 is the ordinary hard pitch of the lake. Report appended.

(Signed) P. CARMODY, *F. I. C. and F. C. S., etc.,*
Government Analyst and Professor of Chemistry to the Royal and St. Mary's Colleges.

Government Laboratory,
Port of Spain, Trinidad, May, 4, 1892.

CONSULATE OF THE UNITED STATES OF AMERICA.

TRINIDAD, W. I., May 5, 1892.

This day, personally appeared P. Carmody, F. I. C. and F. C. S., known to me to be the government analyst of this place, and acknowledged the foregoing certificate of analysis, to which his signature is attached to be his voluntary act and deed.

Given under my hand and the seal of this Consulate, this day and year hereof.

(Signed) WM. P. PIERCE, *U. S. Consul.*

[CONSULAR SEAL.]

The report of Mr. Stevenson Towle says further: "Trinidad asphalt is extensively used in Europe in the *pavement of sidewalks*, and a condition in the specifications for such work is, that the asphalt shall be viscous and not brittle under ordinary temperatures." That is to say the Trinidad Asphalt is used in the preparation of a mastic, with the natural rock-asphalts, which mastic is principally used for roofing and the laying of sidewalks, and not for street paving. Street paving in Europe is almost exclusively done with rock-asphalt, whenever asphalt streets are specified. The large exportation of Trinidad Lake asphalt to Europe are made because the importers of asphalt in Europe belong to the pool, which controls the exclusive right to mine the Lake-asphalt. It does, therefore, by no means "indicate that the lake-asphalt alone meets the requirements of foreign specifications."

During the year 1890, up to the end of it, 19,968 tons of crude asphalt, taken from lands outside of the lake, were imported into the United States, making a total, during the four years from 1888 to 1891, inclusive, of 50,695 tons of crude asphalt, and 4,834 tons refined. Fifty thousand tons crude yielding about 60 per cent. of refined or 30,000 tons. Add to these the 4,800 tons refined, making in all 34,800 tons of refined Trinidad Land Asphalt imported into the United States during the last four years. Of these at least 66 per cent. have gone into the pavements, or in round figures, 24,000 tons have been used for paving purposes. These 24,000 tons will have laid 1,200,000 square yards of pavement.

Does Mr. Towle claim that the whole 1,200,000 have been a failure? If not, then his deductions and recommendations are entirely wrong.

It would be interesting to know who imported all this asphalt, and who laid the streets, claiming that nothing but Lake-asphalt had been used.

NEW YORK, Aug. 8 1892. JULIUS SCHUBERT.

The lake and land asphalt question is up in Washington before the commissioners of the District of Columbia, before whom it was recently discussed by representatives of the Barber Asphalt Paving Company and the Schillinger Asphalt Paving Company. Mr. Mills Dean, L. P. Wright and Hugo Reid appeared for the Schillinger Company, while Mr. J. J. Darlington and J. C.

Rock spoke for the Barber Company. Early in July the commissioners opened bids for street paving. Proposals were submitted by the Schillinger company, the Barber company, and the Cranford company. The Schillinger company was the lowest bidder for some of the streets and claims the contract for the work.

The Schillinger company uses what is known as "land asphalt," and the Barber company argues that it is not equal to the asphalt used by the Barber company. The Washington *Post* gives the following report of the discussion before the commissioners:

"Mr. Hugo Reid, vice-president of the Trinidad Asphalt Refining Company, explained that there was really no material difference between the land and lake asphalt. For every practical purpose the former had been proven to be equally as good as the latter, containing as much pitch, and he proceeded to show that the Barber company, when it commenced business, established its reputation solely by the use of land asphalt, and that some of the best work laid in the streets in Washington was laid with the same material that the company is now endeavoring to condemn.

"Mr. J. C. Rock, a former employe of the District, who is now with the Barber company, recited instances of failure of streets laid with land asphalt, and was confronted by Mr. Reid with similar instances where lake asphalt had proven equally inadequate.

"The legal aspects of the question were discussed by Mr. Mills Dean on behalf of the Schillenger company, who claimed that the Barber company was enjoying a monopoly and that it was only trying to keep the new company from showing what it could do.

"Mr. Dean also claimed that as the company had filed a sufficient bond, and was the lowest bidder and fully prepared to carry out every requirement and detail of the specifications, including the five years' guarantee, it should be awarded the contract without question.

"As the law requires that the commissioners shall use none but the best material in paving the streets, the matter will be fully investigated before any contracts are awarded. In order to test the quality of the land asphalt, Prof. Richardson, the district chemist, and an expert on asphalt, was sent to New York to investigate the matter."

THE FIRST BRICK STREET PAVEMENT IN AMERICA.

DR. J. P. HALE, of Charleston, W. Va., writes for PAVING AND MUNICIPAL ENGINEERING the following account of how the first brick street pavement in America was laid under his direction at Charleston:

To the Editor of Paving and Municipal Engineering:

In 1869 I contemplated building myself a house, but, as the brick of the town were very rough—old fashioned, hand-made, mud brick, I bought a brick machine (Gard patent), the first ever in the valley, and probably the first brick machine ever in the state. The machine worked plastic clay. The brick were moulded under heavy pressure, and when hard burned made a superior and very hard brick, so much harder than any ever seen here before that it was a subject of general remark. Our town is built on stiff yellow clay (just the clay these bricks were made of), and our streets were almost impassable in winter. The only paving material used here was broken sandstone, which was little better than nothing. I proposed to our city council to pave a street with these hard brick, but the proposition only met with ridicule; it was thought to be absurd. So, having asked their permission, I laid a block in Capital street, next to Kanawha street, the most used and most trying position in the city. This I laid at my own expense, in face of the total incredulity of the whole city, but to the great surprise of the public, as well as the city council, the pavement remained firm and solid, week after week, month after month, and year after year, until in 1873 when the council were so far convinced of its value that they consented to have laid and paid for a pavement in Summers street, from Kanawha to Virginia streets. This street has been in constant and hard service every day from 1873 to date, 19 years. And is, to-day, in sound, serviceable condition. I doubt if it has cost the city, within that time, $25 for repairs. If there is a pavement in America of superior record, I should like to know it.

In 1881, the experimental block of about 33x33 feet, which I had laid in Capitol street, still sound and perfect after eleven years' use, was taken up to regrade the street and pave it with brick from end to end, since which time no other than brick pavement has ever been laid in the city, and it is safe to say never will be. We have now six or seven miles of it, and are laying more from year to year, as fast as the city finances admit of it.

The shape and size of the brick are the same as the usual building brick; no change whatever. It is customary here to burn kilns to get three grades of brick: Paving brick, sidewalk brick, and building brick. The kilns are burned to all they will stand, the hardest being used for paving, the next hardest for sidewalks and the balance are just right for building, and so there is no loss.

J. P. HALE.

A CENSUS OF STREET TRAFFIC.

THE Indianapolis Board of Public Works recently took a traffic census of some of the principal streets of the city.

The instructions to each observer were the same used in many other cities, and only a slight modification of those designed and used by Captain F. V. Green, who in 1885 had this kind of a record taken upon a large number of streets in the different cities of this country.

The hours of observation were from 6 A. M. until 7 P. M., standard time, and from Sunday morning until the following Saturday night, thus continuing on each street for seven full days. One day on each street the traffic was taken from 6 A. M. until 11 P. M., so as to include the entire traffic, but this traffic, together with bicycle traffic, slips and falls, the kind of weather which prevailed during the period of observation, is not included in the tables below, but will be found among the papers on file in the office of the board of public works, as may also the number of single vehicles, empty and loaded, the number of double horse vehicles, empty or heavily loaded. The same with reference to carts and wagons; also whether each horse or team was walking, trotting or speeding; also, all horse-back riding.

In estimating the tonnage the light-weight vehicles were estimated at half a ton each, including load, the medium weight two tons, the heavy weight four tons, and horses half a ton each. Multiplying the total number of vehicles in each class by these figures and adding together the product the total vehicle tonnage was obtained; the same way with the horses. Then dividing this by the number of days of observation and the width of the pavement between the curbs, excluding the street-car tracks, we get the daily average tonnage per square foot of surface, which is the unit of comparison.

This is supplemented by a report as to the structure of the pavement, whether clean or dirty, and exceptionally heavy loads, etc.

There seems to be a general misunderstanding among the observers—who were young men just out of school, or clerks and accountants of a superior grade of intelligence—as to the kind of pavement on Washington street, between Mississippi and Alabama street; Pennsylvania street, between Washington and Ohio, and Illinois street between Washington street and the tunnel. These were each reported on the first day as asphalt pavements, whereas, they are each coal-tar or vulcanite, differing from the asphalt in two respects: First, they have no hydraulic cement concrete base, and second, coal-tar is used in making the wearing surface instead of asphalt.

The observations on the streets having the * next to the name were taken on the dates from June 19 to June 25, inclusive, and those without * from June 26 to July 2, inclusive:

TONNAGE OF INDIANAPOLIS STREET TRAFFIC.

No.	STREETS.	Point of Observation.	Width of Roadway.	Year Paved.	Material Paved with.	Average Number of Horses per Day.	Average Number of Vehicles per Day.	Average Number of Tons per Day.	Average Number of Tons per Sq. Ft. per Day.	Tons per Year per Foot.	Condition of Pavement.
1	Washington	Near Pennsylvania	66	1888	Coal tar or Vulcanite.	6,931	5,894	7,244	110	40,150	Poor.
2	Illinois	Near Maryland	46	1890		3,198	2,762	3,245	101	36,865	Good.
3	Pennsylvania	Near Market	46	1889		4,673	4,194	4,675	101	36,865	Fair.
4	Ohio	Near Pennsylvania	40	1890	Trinidad asphalt	4,417	3,680	4,369	109	40,685	Excellent.
5	Massachusetts avenue	Fire dep't headquarters	32	1891	Trinidad asphalt	3,751	3,245	3,746	117	42,705	Excellent.
6	Delaware	Bet. North and Walnut	40	1891	Trinidad asphalt	4,131	3,513	4,434	110	40,150	Excellent.
7	Delaware*	Near Fifth	40	1886	Red cedar blocks	2,348	2,609	2,141	53	19,345	Poor.
8	Delaware*	Near McCarty	32	1891	Vitrified brick.	1,213	926	1,238	38	13,870	Excellent.
9	Meridian*	Bet. 10th and 11th	30	1891	Trinidad asphalt	1,646	1,447	1,514	50	18,250	Excellent.
10	Meridian*	Near Pratt	40	1882	White cedar bl'ks	2,271	1,929	2,335	58	21,170	Bad.
11	Seventh	Near Pennsylvania	30	1891	Trinidad asphalt	1,933	1,643	2,041	68	24,820	Excellent.
12	College avenue*	Between 6th and 7th	40	1891	Vitrified brick.	1,057	851	1,084	27	9,855	Excellent.
13	St. Joseph	Bet. Pa. and Delaware	30	1891	Vitrified brick.	417	347	491	16	5,840	Excellent.

For comparison with the foregoing the following information regarding the traffic on the streets of other cities compiled from authentic reports of engineers, by Mr. Charles A. Kenyon, of the Western Paving and Supply Company, is furnished:

TONNAGE OF STREET TRAFFIC IN OTHER CITIES.

Name of Street.	Name of City.	Kind of Pavement.	Tons per Ft. per Day.
Gracechurch	London, England	Asphalt	422
The Poultry		Asphalt	378
King William		Granite	203
*Broadway	New York	Granite	273
Fifth avenue	New York	Asphalt	94
Broad	Philadelphia	Asphalt	142
Chestnut	Philadelphia	Granite	74
Kilbey	Boston	Asphalt	126
Washington	Boston	Granite	75
Wabash avenue	Chicago	Granite	142
Dearborn avenue opp. Wash. park	Chicago	Asphalt	69
Locust	St. Louis	Asphalt	103
Pine	St. Louis	Asphalt	70
Broadway	St. Louis	Granite	72
Main	Louisville	Granite	69
Eighth	Louisville	Asphalt	67
Pennsylvania	Washington	Asphalt	65
Seventh	Washington	Granite	29
Fifteenth	Washington	Asphalt	66
Douglass	Omaha	Asphalt	47
Farnham	Omaha	Granite	24
†Race	Cincinnati	Asphalt	203
†Second	Cincinnati	Granite	196
†Main	Cincinnati	Asphalt	103
†Main	Buffalo	Sandstone	47
†Main	Buffalo	Asphalt	36
†Euclid avenue	Cleveland	Medina	42
†Superior	Cleveland	Medina	77
†East Broad	Columbus	Brick and Asphalt	72
†State	Columbus	Brick	14
†Fourth	Columbus	Brick	23
†Franklin	Peoria, Ill.	Brick	39
†Chapline	Wheeling, W. Va.	Brick	23
†Sixteenth		Brick	18

*Includes vehicles only.
†Includes horses and vehicles.

Traffic in Paris is very heavy, but is not kept in this way, but by the number of horses and vehicles, and is as high, in one place, as 33,000 vehicles and 42,000 horses per day.

Mr. Kenyon, commenting on this census, says: "This matter of traffic over pavements is a test of durability and is a different matter from that of their cost. It involves a careful consideration of the character of traffic, its volume, and the attention given to cleaning and repairing the pavements. This question has been little studied in the country up to this time, but in Europe we find plenty of information. I apprehend this is one reason why they are so far ahead of us in the making of roads and streets, but we are coming to it. To claim that a pavement is durable, the legitimate inquiries are, 1. What tonnage does it bear? 2. Is it kept evenly surfaced and in good repair? 3. Is it kept clean?

"The fact that it has been in use ten, twenty or fifty years means nothing until these questions are answered. The measure of durability is the tons that can be passed over it before it becomes so worn that the cost of replacing it is less than the expense incurred by its use. These expenses are hard to determine, being the cost of the extra wear and tear of equipages, abuse of horses, lost time and personal discomfort. Again, the durability of a pavement will vary with the condition of cleanliness in which it is kept. For instance, an inch, or even half an inch, of overlying dirt on a stone or brick pavement protects them from abrasion, and such ought to last forever. Only chemical disintegration will destroy such pavements if kept in that condition."

AN ARGUMENT IN FAVOR OF ASPHALT PAVEMENTS.

MR. VOLNEY W. FOSTER, President of the Western Paving and Supply Company, in a recent interview in the *Chicago Post*, said in reply to questions as to the chief grounds in his judgment, of the opposition to asphalt pavements:

"As compared in first cost with no pavement, or with the cheap forms of road improvements called pavements, our form of construction is expensive. The people generally have not come to look upon the elegant improvement of a street as a part of the necessary expense of building a home. We are slowly coming to it. The fact that 'the public' is a larger user of that portion of their property has abated the interest of the property-holders in the roadway. In fact, in this country we have not given the attention generally to the construction and maintenance of fine roads that has been given in other countries. It occurs to me that the reason that the older countries are so much in advance of us is that in the earlier days, before the use of railways and when the field of activity offered to engineers was limited, that class of men devoted their time and attention to the improvement of roads, and this accounts, in part, in my judgment, for the better condition of the highways of England, France and of the continent generally. I think that at all times there has existed in perhaps the same relative proportion this engineering talent, and when it was circumscribed by other conditions we find it working out in the manner indicated; but when the same class of men were permitted (in the construction of railways, steamboats, suspension bridges and in the field of electricity and other honorable employment) to find profitable opportunities for the exercise of their talents, then, naturally, they availed themselves of such more promising occupations, and so we have been left mostly to the results of mediocre talent in this respect. This, of course, relates largely to our country roads and highways.

"The form of street pavements in cities has been determined largely by the location of such cities in respect to material that could be had most cheaply. I think the city of Chicago has had occasion to be especially grateful in her early career, for the fact that her location was in close proximity to great forests of cheap material that could provide a passable first improvement upon her streets, and this, too, in those days when the burdens of taxation were very great and the income from property very small. As this city had no natural roads at all, without such material there would have been great hardship in improving her streets. In those days it was not a question of what was best in the long run, or even what was most sanitary, but it was a question, first, of 'Can

we afford to have the cheapest?' and second, 'What is the cheapest?' These conditions no longer exist, and I believe the active question of the hour is, 'What is the best form of pavement to be adopted for this city for each of the different kinds of traffic?' And in this direction, as well as in others, the growth of sentiment already demands that sanitary conditions should be first considered.

"The soil or earth in and about our city is largely 'filling.' That is to say, most of our streets are filled with the waste earth taken from excavations and street sweepings, and such filling would generally be considered a mass of unwholesome earth. The exhalations from such 'filling' would generally be believed to be not conducive of health, but this condition exists and can not be changed. I believe it would be conceded by engineers generally and by sanitary officers that a six-inch hydraulic cement concrete placed upon such a subgrade would hermetically seal it, and after such masonry was constructed that there could be no fear of exhalations from this source. I believe that it would be a wise provision of our municipal authorities if they would determine that such a base faithfully constructed should make the foundation of every city pavement. As the soil upon our streets varies greatly in its consistency and density, it is only by the use of such a base that a uniform and homogeneous foundation for a pavement can be had. Such a base subjects all parts of the wearing surface of the street to equal wear, and if such concrete is constructed in the best possible manner it will last for an indefinite period of time—hundreds of years if not disturbed. Such a base can be perfectly repaired when purposely cut. To be sure, the same faithfulness to detail would have to be observed in such repairs as was observed in the first construction.

"Now, having taken such pains to construct an impervious base it naturally suggests that the finished work should furnish an impervious wearing surface. I contend that a street that is paved with material laid in pieces is only partly paved, and if necessity prevents the paving of a whole street that it will be far better that such unpaved parts should be all in one place rather than scattered throughout the street. It has occurred to me at times that there was something ludicrous about boards of wise and scientific officials discussing how they should fill up holes or interstices of the street, with what material and with what manner of workmanship, when reflection would suggest to them that they need not have those holes at all. Certainly that form of pavement that can be most easily and perfectly cleaned would be desirable for this reason. It is utterly impossible to clean a street that is paved with pieces or blocks. The attempt to clean such a street takes from the surface a portion of the dirt and drives the balance of it into the holes and interstices of the street, so that you can not at any time say that such a pavement is clean.

"The forms of pavement offered are granite blocks, cedar blocks, macadam and asphalt.

"There can be no excuse for the use of granite blocks for pavement except necessity. They are a cruel contrivance—are as painful to horses as they are uncomfortable for people—and still it may be found that there are certain areas where such pavements are necessary. That could only be determined after it was ascertained what it would cost to maintain an asphalt street in such an area and after wise calculation was made as to the desirability and the profitableness of the use of such pavement, considering its effect upon vehicles, animals and human nerves. I strongly suspect that when such careful calculation was made no area in the city would be found to demand granite blocks.

"The cedar blocks I think I have paid sufficient tribute to as a pioneer of pavement. There is nothing scientific about the construction of such a pavement and nothing progressive nor advanced in the theory of their use. A cedar block is the most absorbent and retentive piece of wood of which I know. There are many thousand cells or breathing holes in each block. Into these cells are inhaled all that comes to them in the wash of the street, and under a hot sun these same germs or gases are exhaled into the atmosphere. The block itself consists of two distinct densities of wood. The heart is about half the exposed area and is harder than the other half, which is the sap. These conditions account for the unequal wear of cedar block pavements—the rounding or 'nigger-headed' form in which they are found. The manner of construction of cedar blocks upon a plank foundation is such that it is impossible to cut into such pavement and foundation for any purpose and again relay the pavement, putting it in the condition it was originally, and this because it is necessary in laying such 'foundation' to break joints with planks of unequal lengths, and therefore you can not uncover the whole section of the base, as there is no such thing as a section. Then, in making a square cut into such a pavement, the bond is lost and destruction easily follows.

"Macadam is, as you have already said, a very indefinite term and may mean in this city a pavement that has cost $2.60 per square yard to lay or may have cost 50 cents per square yard. It is built of the material out of which mud and dust are made. It would seem as though it was not necessary that so great an expense should be incurred to determine what would be the outcome of a macadam pavement. If any property-holder would take a half bushel of broken limestone and devote himself to the investigation, being provided with a hammer and a vessel of water, and would pound the limestone and occasionally pour a little water, imitating the phenomena that occur in the actual use of a macadam street, he would easily determine what would happen and without the enormous expense of laying many miles of it, as has been done. I hold, as a general principle, that any material laid upon a street as a pavement must either break or bend, and I think it would be true of an asphalt street laid of so great a density that there was no elasticity in it that such pavement would be of comparatively short life.

"The chief question in regard to all commodities relating to our necessities and our comforts is not alone, what does it cost? but what is it worth? What are its uses and advantages? This especially would be the question of those holding unimproved real estate. The enhancement in value by the laying of standard asphalt pavements has been uniformly so great as to make it an invariable rule that such enhancement pays several fold the cost of the improvement.

"In conclusion, I claim for asphalt pavements, properly laid, that they are the most sanitary, most comfortable, most elegant, and can be more cheaply kept in first class condition than any other. I am advised that contracts for cleaning such pavements have recently been made in Buffalo at the rate of $7 per mile, whereas contracts for cleaning in Chicago are made from $20 to $23 per mile, and I claim that the asphalt pavement is the only one that can be perfectly cleaned; and lastly, I desire to say just a word about the value of conservation of human nerves. Unfortunately we have no recorded estimate by anybody of the money damage it is to shock, pain or injure the nervous system, but a person does not have to be very ill to be seriously affected by the discomfort of travel upon a rough roadway or by the noise and roar made by traffic on a stone pavement. Some day these considerations will be taken into account and will have as much value as all the others in determining how our streets shall be paved.

"Where street car tracks are maintained on roadways paved with asphalt the grooved rail, such as is in use at Washington and European cities, should be uniformly used. This will add greatly to the life of pavements, preventing the wheel traffic making ruts, as it now does where it is gauged by one wheel in the track and the other six or eight inches outside of the rail. With the grooved rail there could be no tracking of wide-tired vehicles in the car track.

"It has long been a matter of surprise with those noticing legislation in this city that the earnest efforts of our leading newspapers and an almost universal public sentiment have not yet been sufficient to enact and enforce an ordinance relating to the width of tires. The adoption of the wide tire—three or four inches—more than any other one thing would prevent the destruction of our pavements. Permit me to state what I think we may have in the near future and what I think will be the ideal conditions for traffic on our city pavements: First, a well constructed asphalt roadway; second, the pneumatic rubber tires for our carriages

third, our horses shod with shoes made partly of steel and partly of rubber. When our horses, carriages and roadways are so equipped I think we may claim we have accomplished the ideal conditions."

EXHIBIT OF ROAD PAVING MATERIAL.

COL. ALBERT A. POPE, who has so ably and perseveringly urged that a separate exhibit of road paving material shall be made at the Columbian Exposition, does not accept as satisfactory or conclusive the statement that it is now too late to make arrangements for such an exhibit before the opening of the Exposition. He says: "The main buildings are to be dedicated October 12, 1892, and the Exposition is to be opened May 1, 1893. In these intervening months there is ample time to erect a suitable building in which can be grouped all the things which would be useful in educating the people how to build good roads. Every state ought to send cross sections of roads showing the construction best adapted to the particular locality, taking into consideration the most available material of which to build roads. Examples of country road bridges should also be shown. A comprehensive road exhibit at the Exposition would be the most powerful factor to bring about national and state legislation for the construction and maintenance of good roads."

Supplemental to this: "The movement throughout the country for better roads is one of the most significant and important events of the nineteenth century. It is a popular uprising against the bondage which is upon the people that are hampered by poor means of communication; it is a protest against the vicious system of false economy which causes a road tax to be indirectly placed upon every article of consumption; it is the result of the great national discontent with a tariff all the more burdensome because of its insidious and needless character.

"Good roads cheapen the cost of transportation by saving time, reducing the wear of draught animals and of vehicles, and thus lessen the cost of material to the producer and consumer. One of the saddest signs of the times in the older states is the tendency of population toward the cities and the abandonment of farms. The modern development of "slums," the wretched outcome of life in tenement houses can be laid largely to the bad roads existing in the farming districts, which in certain seasons of the year prevent social intercourse, making country life cheerless, isolated, and narrow. Churches and schools are neglected when roads are such as to make them difficult of access.

"The opportunities presented by the World's Columbian Exposition of teaching the twenty million of visitors what good roads are, and how to make and maintain them, should not be lost sight of. A comprehensive display of these things would advance the movement a hundred years and would hasten the coming in of a nobler civilization and a wider Christianity."

THE NEW SEWAGE PUMPS FOR CHICAGO.

THE sewage pumps for Chicago, for which bids were opened on July 25, will be located at the corner of Seventieth Street and Yates Avenue. They are designed to lift all the combined sewage from a well into which the sewers of the district empty by gravity, and deliver it into a 6-foot conduit, which will discharge by gravity into Lake Michigan.

The sewage well will be 16 feet in diameter, and the bottom will be 15½ feet below the city datum, which is the low water level in Lake Michigan. The bottom of the sewers discharging into this well will be 11 feet below the city datum, and the bottom of the discharge conduit will be 1.8 feet below the datum, making the lift for the pumps 9.2 feet.

The pumping plant is to consist of two engines and three boilers. One engine is to have a capacity of not less than 15,000,000 gallons in every 24 hours, while the other is to have a capacity of not less than 28,000,000 gallons. There will be three horizontal tubular boilers of such size and capacity that any two of them shall be easily capable of supplying on a continuous run the necessary steam to operate both engines at their full rated capacity. All the material used in the engines, boilers and their appurtenances is required to be of the best quality of their several kinds, and the contractors are required to guarantee the plant to perform the work specified, without breakage or other defect than normal wear, for one year from and after the date of the former acceptance.

The duty required to be developed, whether the engines are working singly or together, is not less than 70,000,000 pounds of sewage raised one foot high for each 100 pounds of best Lehigh coal used in the furnaces, with natural draught, for a period for not less than 24 consecutive hours. The steam pressure is not to exceed 100 pounds per square inch in the boiler during the duty trial, and the above requirements must be met without any deduction from the coal consumed, for clinkers or ashes, or for any friction of machinery, friction of water in pumps and connections for the use of steam for feed pumps, or for any purpose due to the operation of the machinery as a whole.

The tests are to be conducted by an engineer appointed by the Western Society of Engineers, with the approval of the contractor and the commissioners of public works, the latter to furnish as many assistants from his department as may be necessary.

PUBLIC GARBAGE CREMATORY.

COL. W. F. MORSE of New York City, who has given much attention and investigation to the subject, says the readiest, safest, and most economical way of disposing of garbage is to burn it. From the beginning of civilization fire has been the great destroyer and purifier of dangerous matter, and to-day, he says, the world can show no other agent which so perfectly performs this work. Col. Morse referred to the interview in *The Tribune* with Dr. Clarke Gapon, commissioner of health of Omaha, and intimated that the doctor was only partially familiar with the subject of cremators. Dr. Gapen said:

"We ever and anon see in the newspapers accounts of the wonderful results of the garbage crematory. But the fact remains that it has but comparatively rarely been a success, either from a practical or financial point of view. Crematories have almost universally been abandoned after a short period of use, because too expensive and too limited in their application."

The contrary are the deductions that should be drawn, says Col. Morse. When the matter of garbage gives trouble by its accumulations every valid reason is in favor of disposing of it by cremation. Great Britain has had twelve years' experience in the process, and it not only continues to employ fire as the agent of destruction, but is multiplying its furnaces, and according to official reports commend cremation as "not only practicable, but the best and often the only way of dealing with town waste in a manner to satisfy sanitary requirements."

There are four forms of American furnaces now in use, and health officials and city authorities, according to Col. Morse, say the method meets the wants of its communities by its efficiency, sanitary helpfulness, and economical work. These different styles of cremators or furnaces are known as the Ryder, used at Pittsburgh, the Mann, used in Montreal, the Eagle, used in Des Moines and elsewhere, and the Heavey, recently put in operation in this city. And as to the abandonment of the cremators "after a short period of use" according to the doctor, the contrary is the fact according to the Colonel. For sixteen years, he says, the United States government has destroyed the waste of military posts in a special furnace, and from three to five years' experience of more than thirty cities and towns in Canada and the United States has proved the advantage of the cremation of garbage. Coal or wood can be used in any of the furnaces, but the cheapest and most efficient fuel is gas when that can be readily secured. As the density of population increases the question of sanitation is brought closer to the public mind, and the problem of disposing of disease-breeding filth and garbage becomes more urgent.—*Chicago Tribune.*

A COMPARATIVE TEST OF CEDAR BLOCKS AND ASPHALT.

JAMES G. McBEAN, a wood block paving contractor, has offered to pave half of Washington street, between La Salle and Clark streets, in Chicago, with cedar blocks free of charge if the asphalt companies will pave the other half block with their material as a test of the respective pavements. There is some probability that the offer will be accepted.

AN IMPROVED CULVERT BRIDGE.

IMPROVEMENTS have just been made by William A. Nichols, Philadelphia, in a new style of culvert bridge, patented by him about three years ago. It is claimed for it that by reason of its cheapness and superiority in all respects, it will take the place of all small bridges now used. The foundation, which is made entirely of wrought iron, consists of two sills, the same length as the bridge, which form the base-pieces, and upon which rest the girders or trusses, which rise therefrom to the desired height, depending upon the size of bridge required, and to them the plank or metal forming the top and side coverings are fastened. These girders are arranged in pairs, inclining towards each other, their top horizontal portions being fastened together, and at the bottom they are securely bolted or riveted to the sill-pieces. The top is generally covered with plank (except when used for railroad culverts), and the sides may be covered with iron or plank, at the option of the purchaser; iron sides are, however, the most desirable. It is put in position by digging trenches on each side of the stream, the same as if to receive the first course of a stone foundation, to a depth a little below the bed of the stream, sufficient to secure a solid foundation for the sill-pieces to rest upon, then the iron sills are set right down in the trenches, the earth filled in and rammed down well, so as to make it solid like the rest of the road, the bridge is then ready for use. It is claimed that the bridge is adapted to all small streams, runs, branches, and low and marshy places where bridges, culverts or blind ditches are required in roads, lanes, streets, turnpikes, railroads, farms, etc. Right to use it is offered on a royalty.

VITRIFIED BRICK IN NEW YORK.

F. A. DUNHAM, city engineer of Dunkirk, N. Y., says: "I consider brick for business streets in small cities far preferable to macadam. If properly put down on a concrete foundation, six inches deep, it should last for from fifteen to twenty years without much repairing. Of course, in time the corners will wear off, as will those of the best blocks used. The cost of the brick pavement so far will average about $2.30 per square yard. The present year we propose putting some down on a broken stone foundation, which will reduce the cost to from $1.75 to $2 per square yard. I prefer a concrete foundation, but think if carefully put in and thoroughly rolled, the ballast foundation will be all right, especially on streets where the travel is light. I would oppose anything but a concrete foundation for a business street, or a street with heavy carting. The cost to property owners fronting on the street will average about $6 per frontage foot."

NEW PATENTS.

V. H. LOCKWOOD, patent attorney and solicitor, No. 60 East Market street, Indianapolis, reports the following list of patents issued during July of interest to our readers. Copies can be procured of him if desired:

Stone Moulding Machine. No. 478,226. W. H. Evans, Baltimore, Md.

Machine for Moulding Stone Slabs. No. 478,227. W. H. Evans, Baltimore, Md.

Method of Forming Asphalt Blocks. No. 478,626. S. McCarter, Morristown, Pa. Assignor to the International Pavement Company, Hartford, Conn.

Brick Machine. No. 478,915. W. Burkman, San Francisco, Cal.

Paving Brick. No. 478,612. D. Lance, New Cumberland, W. Va.

Conduit System for Electric Railways. No. 478,956. W. H. Ford, St. Louis, Mo. Assignor of one-half to W. A. Stickney, same place.

Gravel Road. No. 478,862. T. J. Hoyt, Chicago, Ill. Assignor to The Hoyt Macadam Gravel Road Company, same place.

Street Sweeping Machine. No. 478,942. E. O. Pease, Jersey City, N. J.

Pavement. No. 479,002. E. Hill, Sheffield, England.

Brick and Tile Machine. No. 478,471. J. Thompson, Bucyrus, O. Assignor to the Frey-Sheckler Company, same place.

Cutter for Brick and Tile Machines. No. 478,436. Oliver J. Johnson, Bucyrus, O. Assignor to Frey-Sheckler Company, same place.

Brick or Tile Machine. No. 478,267. J. C. Titus, New Bremen, O. Assignor to the New Bremen Machine Company, same place.

Brick Press. No. 478,625. S. McCarter, Morristown, Pa. Assignor to the International Pavement Company, of Hartford, Conn.

Brick Cutting Machine. No. 479,159. E. Stern, Helmstedt, Germany.

Road Grader. No. 479,466. H. J. Schneider, Fort Wayne, Ind. Assignor to C. Page, same place.

Road Working Machine. No. 479,700. W. G. Bunnell, Chicago, Ill. Assignor to F. C. Austin, same place.

Clay Conduit Machine. No. 478,462. J. J. Powers and R. Van Buren, Brooklyn, N. Y.

Sewer Excavating Apparatus. No. 478,254. W. Davy, Kenosha, Wis.

Pipe Coupling. No. 478,496. Joseph Aird, Tipton, England.

Sewage Separating and Purifying Apparatus. No. 478,539, W. F. Goodhue, Milwaukee, Wis. Assignor of one-half to C. Paulus, same place.

Sewer Trap. No. 478,808. R. Newton, Providence, R. I.

Machine for Making Cement Pipes. No. 479,451. E. Eehill, Omaha, Neb. Assignor to J. W. Bedford, same place.

Bridge. No. 478,438. T. H. Kosur, Farmersville, Tex.

Suspension Truss Bridge. No. 479,081. G. A. Stephenson, Los Angeles, Cal.

Electric Lamp Suspension Bar. No. 478,275. T. Dillon, Indianapolis, Ind. Assignor of one-half to J. Caven, same place.

Lamp Post Sign. No. 479,006. C. F. Kuechler, Chicago, Ill Assignor of one-half to F. Rahm, same place.

PERSONAL.

Col. Worth has been appointed city engineer of Creede, Colo.

Mr. A. G. Norton has been appointed inspector of the brick paving at Cleveland, Ohio.

Mr. E. Keating, of Duluth, Minn., has accepted the position of city engineer of Toronto, Ont.

Mr. E. W. Groves has been elected chief engineer of the board of public works of Austin, Tex.

Mr. Lewis Hills has been appointed superintendent of sewer construction at New Britain, Conn.

Major J. W. Howard of New York has returned from his periodical tour of paving inspection in Europe.

Mr. John Bogart, M. Am. Soc. C. E., has been appointed chief engineer of the rapid transit commission of New York City.

F. A. Dunham, civil engineer, Plainfield, N. J., has been appointed engineer in charge of street improvements at Oleon, N. Y.

Mr. G. A. Kimball, of Somerville, Mass., has been engaged as consulting engineer by the sewer commissioners, of Brockton, Mass.

Walter C. Curtis has resigned as superintendent of the Alton Water Works Co., at Alton, Ill. T. A. Taylor, of Omaha, will take his place.

Mr. Marion W. Kingsley has been appointed superintendent of the water-works division, department of public works, Cleveland, Ohio.

Mr. E. M. Pike, of Chenoa, Illinois, has bought the interest of his former partner, J. Castle, in the patents of the New Discovery Kiln ware, and will hereafter look after the business alone. The demand for the kiln, which has peculiar advantages, continues to grow.

NEW PUBLICATIONS.

The *Clay Record* is the name of a new monthly journal which has been started in Chicago, under the general management of Dixie Doyle, who has had experience on kindred publications. The new journal makes a promising beginning.

The *Western Builders' Gazette*, devoted to the building trades, has appeared at St. Louis. It is the official organ of the St. Louis Builders' Exchange, but seems to have some purpose of filling more than a local field. It will be published weekly. It is neat in appearance, is well edited and looks substantial.

Stone, the leading publication devoted to the stone interests, issued by the Ranck Publishing Company, of Indianapolis, has been changed from journal to magazine form, and generally improved in appearance. It is one of the very handsomest and most ably edited trade publications in the country.

Improvement and Contracting News.

PAVING.

The citizens of Seneca, Kan., want paved streets.

Montclair, N. J., will improve Mountain avenue.

Columbus, Ohio, is to have a $65,000 boulevard.

The streets of Menominee, Mich., are being paved.

Detroit street will be the first to be paved at Kenton, Ohio.

Worthington street is being macadamized at Defiance, O.

The streets of Alvin, Texas, are to be graded and graveled.

Seventeenth, K and H streets, are being paved at Lincoln, Neb.

Toronto, Ont., has voted $150,000 to improve Exhibition Park.

Street paving will be done at Hastings, Neb., with home-made brick.

Greenville, Ohio, will pave its main street with brick at a cost of $21,245.

Miller & Egan will pave Central avenue with brick at Nebraska City, Neb.

A contract for 110,000 yards of street paving has been let at Evanston, Ill.

Two of the principal streets at Palestine, Texas, will be paved this season.

The street paving work at Bay City, Mich., is being pushed rapidly forward.

J. O. Bates received the contract for a mile of fire-brick paving at Steubenville, Ohio.

A. M. Smith has a $50,000 contract at Asheville, N. C., for laying Belgian block pavement.

Union avenue, New Haven, Conn., will be widened to 85 feet and paved with granite blocks.

The contract has been let for a sandstone pavement on Lower Eighteenth street at Denver, Colo.

There is now practically no doubt that Third street, Wausau, Wis., will be paved this season.

The long delayed work of paving South Seventeenth street has been commenced at Lincoln, Neb.

Asphalt pavement will be laid on Clinton street, Clinton Park and Vine street at Rochester, N. Y.

Nate McCoy received a $50,000 contract for street improvements to be done in Hartford City, Ind.

West Fifth street, at Superior, Wis., will be paved by October 1. Wilson & Thatcher are the contractors.

The council of Tonawanda, N. Y., has voted to issue bonds for $144,595, to pave three streets with brick.

Bids will be received until August 29th, for grading, macadamizing, etc., Chestnut avenue, Fern Bank, Ohio.

The widening of Eleventh street, from Grand avenue to the eastern city limits, at Kansas City, will enable the park and boulevard commissioners to transform the treet into a boulevard.

Messrs. Gilman & Shorthill have been awarded the contract for paving Main street at Marshalltown, Ia.

Another block of asphalt is to be laid on Broad street between Jackson and McIntosh streets at Augusta, Ga.

First, Washington, Division, Hutton, Renssalaer and Adams streets at Troy, N. Y., are to be paved this year.

The committee on streets and alleys at Aurora, Ill., has recommended the paving of several streets in that city.

Five thousand dollars have been appropriated for work on the Powderhorn Park improvement at Minneapolis.

A red shale turnpike road is to be constructed between Wilkes Barre and Glen Summit, Pa., at a cost of $10,000.

The board of works committee, of Toronto, Canada, have awarded contracts for $200,000 worth of asphalt paving.

Western avenue, Allegheny, Pa., will be paved with asphalt blocks. It will require about 250,000 blocks for the work.

A boulevard and carriage drive along the north bank of Minnehaha creek, below the falls, at Minneapolis, is proposed.

The village trustees of Hoosic Falls, N. Y., have purchased a steam road roller to be used in macadamizing the streets.

The aldermen and mayor of Chicago believe that the paving of alleys is a prerequisite to keeping the streets clean.

Lansing, Mich., will spend $14,000 in putting down brick pavements on Washington avenue, one of its principal streets.

Geneva, Ohio, wants paved streets and water-works, and it is predicted that something more substantial than talk will result.

Curbing for a half mile has been laid on West Fifth street, at Superior, Wis., in preparation for paving to be done on that street.

The council of Toledo, O., has passed an ordinance providing for the paving of Western avenue from the canal to Wayne street.

When Cleveland street, from Michigan to Bond streets at East Saginaw, Mich., is paved, it will be one of the finest streets in the city.

Main street, Viroqua, Wis., will be macadamized. R. F. Weston of La Crosse was awarded the contract in consideration of $15,000.

Plans and specifications have been prepared at Terre Haute, Ind., for paving Seventh street with asphalt for a distance of 9,118 feet.

There are $20,000 remaining in the street fund at Chattanooga, Tenn., and about $12,000 of the sewer fund remains to be expended.

The Ott Brothers, of Pittsburgh, were awarded the contract for paving three streets at Uniontown, Pa., in consideration of about $38,000.

The county board of trade of Skagit county, Wash., of which Mt. Vernon is the county seat, has discussed the proposition to build a system of roads in the county, aggregating 140 miles.

A fire-brick pavement on a macadamized foundation is being laid on Ninth street, between Market and Shipley streets, at Wilmington, Del.

At Piqua, Ohio, Madison avenue, from Park avenue to Cherry street and Weber street from Young to South streets are to be graded and graveled.

The residents of Madison avenue, at Youngstown, Ohio, are desirous of having that thoroughfare paved with asphalt at the earliest possible time.

Three thousand square yards of street paving is to be done at Butler, Pa. Vitrified fire brick is the material to be used and laid on West Pearl street.

At McKeesport, Pa., Maple street from Shaw avenue to Olive street, will be paved with brick. The McKeesport Construction Company has the contract.

Brood street, at Elyria, O., will be paved this season by Jacobs & Stewart, contractors. This is an evidence of progress for which Elyria is to be congratulated.

The work of macadamizing roads in Bloomfield, N. J., is being pushed forward rapidly. There is now a continuous stone road between Bloomfield and Patterson.

Columbus, O., has eighty miles of paved streets, of which fifteen are asphalt, fifty of different varieties of brick, and the balance are made of granite and other stone roadways.

Harrison avenue, Detroit, Mich., is noted for its shade trees and since it has been paved with cedar blocks on plank foundation it is one of the handsomest streets in that city.

When Portland, Ore., gets Morrison street paved with asphaltum, it will have three of its principal business thoroughfares paved with asphaltum and bituminous rock.

The finest street in Salem, Ohio, is Broadway, which has recently been paved with brick. The business men of that place are anxious to have Main street paved as soon as possible.

Contracts for grading and paving six alleys with vitrified brick have been recently let at Louisville, Ky. Seventh, Preston, and First streets, will also be paved with the same material.

Four miles of shell roads will soon be completed in Beaufort county, S. C. When completed it will add much to the attraction of Beaufort, the county-seat, which is already an attractive little place.

Edinburgh and one or two cities in Germany have tried the experiment of paving a street with India rubber. They report it to be satisfactory there, but it would doubtless be too hot in America.

Col. Robert Roe proposes that a lake front boulevard for Chicago be built as a viaduct on a straight line south from the Chicago river to Randolph and Twelfth street. The cost is estimated at $1,000,000.

A brick pavement is being laid on East Tuscarawas street, at Canton, O. The preparatory work on this street was very heavy, as all gas, water and sewer connections were put in. A new gas main had to be put down in the street; a storm-water sewer was also put in, and the entire street was reconstructed.

The paving of Stinson avenue from Second to Nineteenth streets at Superior, Wis., is under the supervision of L. M. Searles, who says he proposes to make it the best piece of paving yet done in the city.

An effort is being made on the part of the people and board of supervisors, of Alexandria county, Va., to provide good roads for the entire county. One mile of macadamized road is now being built as a starter.

The following named streets at Waterloo, Ia., are to be paved with brick: East Fourth street from the bridge to Franklin street; Lafayette street from Fifth street to Park avenue and Sycamore street from Fifth street to Park avenue.

The board of administration, of Cincinnati, Ohio, will receive bids until August 23d, for the improvement of Eighth street in connection with the viaduct. The work includes grading, filling, granite curbing macadamizing, brick and cement paving.

Mayor Boody, of Brooklyn, N. Y., has been called upon by a committee representing the property owners on North Third street, from Kent avenue to Bedford avenue, asking the mayor to use his influence in having that street paved with Belgian blocks.

Amsterdam, Holland, has a population of 370,000 and is the cleanest city in Europe. All waste and refuse collecting on the streets or floating in the canal is carried away, sorted over and utilized. The streets are swept every night and the estimated expense of the sanitary service in 1890 was $90,000.

At Kansas City, Mo., the Barber Asphalt Company were awarded contracts for paving Delaware street from Fourth to Ninth streets; Main street from Missouri avenue to Seventh street and Walnut street from Ninth to Twelfth streets. They are to be paved with asphalt and the three aggregate a cost of $55,142.

Marion, Ind., is to have a 30-acre park donated to that city by Phil. Matter. Isaac VanDevanter, A. E. Eyestone and Loren Massey will donate a highway from the proposed Highland avenue bridge to the park, to be 100 feet wide. The street railway company will extend and maintain their lines thereto.

Duluth, Minn., will expend $7,506.01 for improving Eighth avenue west from Third to Ninth streets. Newton & Morrison received the contract. A new street 50 feet wide and over half a mile long, from the Boulevard to Lynne street, through the estate of Richard Squire. John T. Beckwith has been awarded the contract.

Work has been begun on laying the new stone pavement on Seneca street at Buffalo, N. Y. The distance is about one and three-fourth miles and will cost $60,000. First there will be a six-inch concrete base, and on top of that a two-inch cushion of sand, then Medina stone blocks laid with broken joints between which will be an asphaltic filler composed of what is called paving cement.

Initiatory steps have been taken by the council at Ottumwa, Ia., toward resuming the work of paving the streets of the city. Main street will be paved from Wapello to Cass streets; East Main from Union street to Iowa avenue; Market, from Second to Third streets; Jefferson, from Main street to the new Milwaukee depot, and Church street, on the south side, from Myrtle street to the Richmond road.

At Kansas City, Mo., Main street, from Missouri avenue to Twelfth street. is being paved with two inches of asphalt on six inches of concrete. The next piece of work of importance will be the paving of Delaware street from Fourth to Ninth streets with the same material. These streets are paved at present with six-inch cedar blocks on four inches of concrete. The blocks will be removed and a two-inch layer of concrete will be added to the base already down.

The B. C. A., of Dayton, Ohio, passed a resolution providing for further street improvements in the line of paving. By the adoption of the same city civil engineer was authorized to prepare plans and specications for paving Perry street from the south line of First street to the north line of Third street; First street, from the east line of Wilkinson street, to the boulevard; Wilkinson street, from the south line of Monument avenue to the north line of Third street. The above paving is to be sheet asphalt or brick, according to the preference of a majority of the property owners on the streets named.

SEWERS.

Rhinelander, Wis., will have sewerage.

Quincy, Ill., is to have five miles of sewers.

A contract for street sewerage has been let at Antioch, Ill.

A system of sewers will be constructed at Cobleskill, N. Y.

Deadwood, S. D., is planning an extensive system of sewers.

The contract for street sewerage at Waukegan, Ill., has been let.

Reynoldsville, Pa., is sorely in need of a complete sewerage system.

Indications are that Norfolk, Va., will be sewered at a very early date.

Work on the sewers is being pushed rapidly at Grand Forks, N. D.

Sewers will be constructed in Sewer District No. 1 at Conneaut, Ohio.

Work will soon begin on the proposed sewerage system for Marion, Iowa.

A sewerage system extending all over the city is needed at Seymour, Ind.

Pipe and brick sewers are to be constructed in eight streets at Paterson, N. J.

It is proposed to issue bonds for $15,000 for a sewerage system for Montesano, Wash.

The contract for the new sewer at Grinnell, Iowa, calls for its completion by Sept. 1.

Work on the sewer in Union street, Olean, N. Y., has been commenced. It will cost $6,450.

Canton, Ohio, will erect sewage disposal works at a cost of $30,000. It will be on the precipitation plan.

The citizens have voted in favor of constructing a main sewer in the village of West Cleveland, Ohio.

The council of St. Joseph, Mo., directed the finance committee to appropriate $30,000 for the Mitchell avenue sewer extension.

The work of laying the sanitary sewer on South Perry street at Montgomery, Ala., has commenced.

Vitrified brick sewers will be laid at Detroit, Mich., which will embrace about 20 of the principal streets.

The council of Syracuse, N. Y., has directed the city engineer to prepare surveys and estimates for several sewers.

The city of Salisbury, N. C., has contracted with the Salisbury Sewer Company for a complete drainage system.

F. A. Snow was awarded a contract for building about one mile of sewers in the Chestnut Hill district of Brookline, Mass.

Clifton Brothers were awarded the contract for constructing 2,700 feet of sewers at Austin, Minn., in consideration of $2,-901.60.

The council of Pawtucket, R. I., has appropriated $105,150 for sewers, $95,000 of which is for a trunk sewer in Central avenue.

One thousand and five hundred feet of 5-foot brick sewers will be put down in Alexandria, Va. The work is to be done within sixty days from the time of commencement.

Engineer Rudolph Herring has been engaged to prepare plans for a system of sewerage for Sioux Falls, S. D., the plans to cost $1,000.

The lowest bid on the sewer to be constructed across the Twenty-third ward, from State street to the lake, at Chicago, Ill., was for $105,000.

Brockton, Mass., is considering the question of sewage disposal. The town is flat and has no natural drainage. Preliminary plans are to be prepared.

About fifty sewers are being constructed or have been contracted for, and a large number have been completed during the past year at Detroit, Mich.

The Lock Haven Clay Works were awarded the contract by the Council of Renovo, Pa., to furnish sewer-pipe for the sewers to be laid at that place.

The question of ample sewerage for Batavia, N. Y., is one that must soon be met. The citizens are much interested in the work of the sewer commissioners.

The highway committee of York, Pa., is considering a proposition from the National Sewerage Company in reference to constructing the West system in that city.

The total amount to be spent under the present contracts for sewers in Newport, Ky., is $61,291. M. Peters & Son, of Cincinnati, O., were the successful bidders.

The amount appropriated for a sewerage system at Knoxville, Tenn., is $250,000. M. J. Condon & Co. were awarded the contract by the board of public works for the construction of same.

Sealed proposals will be received until August 26th, for the construction of the sewerage system in District No. 2, at Marion, Ohio. Blank forms and specifications can be obtained from the city clerk.

The sum of $62,000 is left to the credit of the O. K. Creek sewer fund, and John May, superintendent of streets of Kansas City, believes it can be very nearly if not entirely completed. As there is yet a large amount of work to be done, it will require much careful planning and a deal of economy to accomplish this.

The board of public works of New Bedford, Mass., voted to lay a sewer in Howard street easterly from Acushnet avenue to Howard street and in Howard street as far as Coggeshall street.

The city council of Great Falls, Mont., has let contracts for this year's sewer construction as follows: Sixth street sewer, Frank Scolten, for $18,093.80; Third street sewer, Martin Tuck, $3,995.

The council of Fairhaven, Wash., has ordered the construction of one more mile of sewers. About $100,000 will have been expended on sewers alone this year, when all now building and contemplated are finished.

The city engineer of Indianapolis, Ind., is preparing specifications for an intercepting sewer in Pogue's Run to cost about $100,000 and the board of public works has ordered the construction of a trunk sewer in Mississippi street.

The sewer work at the World's Fair will include about 64,000 feet of brick and pipe sewers from six inches to three feet, six inches in diameter. A plant capable of removing and chemically treating 10,000 gallons per minute will be erected.

It has been voted by the city council of Austin, Me., to put in an extensive system of sewerage in accordance with plans and specifications previously adopted. Clifton Bros., of Fairbault, were awarded the contract, and the work will be completed this fall.

A large amount of sewer work is now under way at Portland, Ore. The Thomas Creek sewer is done, and the 1,100-foot sewer for Portland Heights has been commenced. Plans are also completed for two other sewers, aggregating 2,900 feet in length.

The project of building a county sewer from Plainfield, N. J., to Newark Bay is being agitated in central New Jersey. Each town through which the sewer passed would be called on to pay its pro rata share of improvement. The project is being carefully considered by the various municipalities along the Central Road, which need a safe system of sewerage more than they do any other improvement.

An improved sewerage and drainage system for Indianapols, Ind., is proposed and has recently been reported upon by Mr. Rudolph Hering, Mem. Am. Soc. C. E. Mr. Hering recommends a combined system designed to provide for a population of 240,000. A maximum rain-fall of 3 ins. per hour is assumed. This is based on the records of heavy showers in Indianapolis for the 21 years, 1871 to 1891, during which time there have been 20 showers at the rate of 1 in. per hour and over, 8 of more than 2 inches per hour and one at the rate of 5. 76 ins. per hour. The disposal of the sewage, as recommended, will be by gravity into White River.

WATER-WORKS.

Coleman, Texas, is to have a system of water-works.

A 3,000,000-gallon reservoir will be built at Wyoming, O.

Hartington, Neb., is discussing the water-works question.

The citizens of Wakefield, Neb., voted $7,000 in bonds with which to erect a system of water-works.

Troy, Ala., will put in a water-works plant to cost $37,000.

Water-works to cost $18,000 will shortly be built at Wayne, Ia.

Water-works will shortly be constructed at North Vernon, Ind.

At Spadra, Wash., water-works will shortly be constructed.

A $28,900 system of water-works is being put in at North Bay, Ont.

The water-works plant at Cassopolis, Mich., has been completed.

A system of water-works is among the possibilities for Cameron, Texas.

The water-works system at Rockford, Ill., is to be improved and extended.

The contract for putting in a water-works system at Iowa Falls, Iowa, has been let.

T. A. Hardman secured the contract to put in a system of water-works at Arcola, Ill.

Kalamazoo, Mich., will invest $15,000 in extending the water mains for fire protection.

A stock company with $100,000 has been organized to build water-works at Ottawa, Kan.

It is reported that a 100,000-gallon brick and concrete reservoir will be built at Salem, Va.

Westport, Conn., will erect a 25x65-foot stand-pipe in connection with its new water-works.

The residents of Chapel Hill, N. C., are considering the construction of a water-works system.

BRIDGES.

Lansing, Mich., wants a bridge across Grand river at Franklin street.

A bridge will be built over Crawford's Run on Lane street, at Hamilton, O.

Waupaca, Wis., is about to build an iron bridge across the Waupaca river, at a cost of $2,476.

An iron bridge with stone abutments will be built over Pascack Brook, at Hillsdale, N. J.

The new bridge over the Missouri river at St. Charles, Mo., being constructed, will cost $2,000,000.

A new $25,000 bridge is to be built over Pogue's Run on Washington street, at Indianapolis, Ind.

Four miles southeast of Highland, Ill., a highway bridge will be built of iron. It will be fifty feet long.

A new bridge has just been completed across Brush Creek, on West Market street at Johnson City, Tenn.

Two iron bridges will be erected across the North and South Forks of the Shenandoah river, at Riverton, Va.

The new steel bridge across the Willamette river at Albany, Ore., has been completed, accepted and open to travel.

County Engineer Dun submitted plans for the proposed new Town street bridge, which is to span the Scioto at the city prison, Columbus, Ohio. The legislature has authorized an appropriation of $50,000 for this purpose and the estimate of Mr. Dun is $49,355.

The total length of the new high wagon bridge at Winona, Minn., is 1,755 feet, and is 72 feet above low water mark; its cost was $100,000.

P. H. Eberhard, of Kansas City, was awarded the contract for a 45 foot span iron bridge over Troublesome Creek, two miles south of La Belle, Mo.

The Missouri Valley Bridge Works of Leavenworth, Kan., received the contract for constructing a new steel bridge across the Missouri river at Leavenworth.

The rebuilding of the railroad bridge across White river, one-half mile east of Buckley, Wash., will cost in the neighborhood of $50,000.

The Hackensack river is about 800 feet wide at Jersey City, N. J. and the bridge committee recommends the construction of an iron bridge, with a swing span.

The Secretary of War has decided against the application for permission to build a bridge across the Hudson river between the north end of Albany and Bath, N. Y.

The sum of $8,000 has been appropriated for the construction of a bridge across the Rio Ilare, Peru, a short distance south of Puno, in the department of the same name.

The board of supervisors of Jo Daviess county, Ill., has voted $20,000 to assist in the construction of new bridges in that county, which were swept away by recent floods.

Engineer Weaver prepared plans and specifications for the abutments and wing wall for an iron bridge over Dry Fork Creek, at Hamilton, Ohio, which have been adopted.

The piers of the Jeffersonville and Louisville bridge stand in the Ohio river as monuments of the wreck of the Masonic bank of Louisville and a sunken fortune of nearly $1,000,000.

A new bridge is to span the American river at Folsom, Cal. The San Francisco Bridge Company were awarded the contract of $30,350. The bridge is to be entirely of steel.

STREET LIGHTING.

Sheldon, Ia., is to have an electric light plant.

Homer, Mich., is to light its streets by electricity,

Hudson, Mich., is to have an electric light plant.

Spring Valley, Ill., will own a municipal lighting plant.

Water-works and an electric light plant are contemplated at Monroe, La.

Bids will be advertised for street lighting at Pueblo, Col., for five years.

An electric light company is being organized at Redwood Falls, Minn.

An electric light plant will soon be put in process of erection at Savannah, Mo.

The citizens of River Point, R. I., have voted in favor of electric street lighting.

A new company is being organized at York, Pa., to put in the Westinghouse system.

The Fountain City Land and Improvement Company contemplates the erection of an electric light plant at Fountain City, a suburb of Knoxville, Tenn.

An electric light company with a capital of $15,000 has just been organized at Maryville, Tenn.

It is reported that an electric light plant will be established at Gonzales, Tex., by T. S. Walker.

It has been voted to issue bonds for $23,500 for water-works and electric lights at Kent, Wash.

The council at North Tonawanda, N. Y., has voted to extend the electric light service at Martinsville.

A franchise has been awarded the Elkton Electric Light Company, at Elkton, Md., and will at once construct a plant.

The Fenton Electric Light Company, at Fenton, Mich., will soon award contracts for improvements to cost about $10,000.

SEALED PROPOSALS.

PERMANENT SIDEWALK PAVEMENTS.
(Concrete and Brick.)

CITY OF MATTOON, ILLINOIS.

Notice is hereby given that the City Council of said City of Mattoon will, on Tuesday, September 6th, 1892, receive and open sealed bids for proposals to contract to furnish materials and perform work particularly described in an ordinance for construction of permanent sidewalk on both sides of Broadway between West First Street and East Third Street, passed July 13, 1892.

Copies of said ordinance and other information desired can be had on application to the city clerk.

Work to be performed within sixty days after contract is signed. Amount of work contemplated not less than 2,000 running feet of frontage or more than 2,500 feet. Width of walk, twenty-five feet.

Certified check or draft of $200 will be required with bid as evidence of good faith.

Attest: FRANK KERN, Mayor.
CHAS. HOGUE, City Clerk.

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IF YOU CONTEMPLATE A TRIP TO

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L., N. A. & C. R'Y.

The New Management having entirely rebuilt the line, putting in over 300,000 new ties, miles of new steel, new iron bridges, etc., etc. This, in connection with elegant **Pullman Perfected Safety Vestibule Trains,** composed of DAY COACHES, PARLOR and DINING CARS (the only line running Dining Cars between Indianapolis and Chicago), and Pullman Buffett Sleepers, makes this

THE LINE between Indianapolis and Chicago, also the Short Line, only 183 Miles Indianapolis to Chicago.

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GREAT MONON ROUTE.

Ticket Offices, 26 South Illinois Street, Massachusetts Avenue and Union Station.

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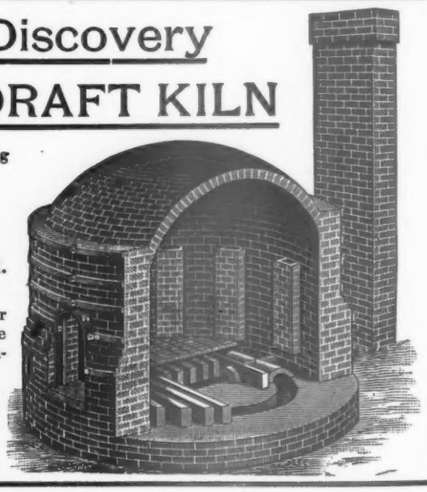

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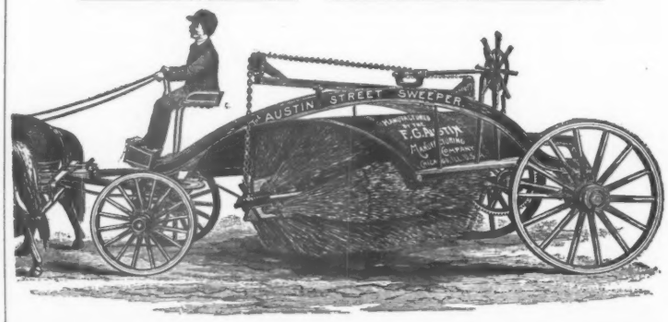
STREET SWEEPER



Streets 28 feet wide between curbs are cleaned in two rounds.
Operated by driver and two horses. For particulars, address

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H. H. WAINWRIGHT,
PATENTEE.

The Anchor Artificial Curb

IRON BOUND AND
NON-BREAKABLE.

STATE RIGHT AND LICENSES FOR SALE.

PATENTED MAY 20, 1890.

ESPECIALLY ADAPTED FOR STREETS, WHARVES, RAILROAD DEPOTS, PIERS, ROADWAYS OF BRIDGES, MARKET HOUSES, BREWERIES, WAREHOUSES, ETC., ETC.

THE INVENTOR of the Anchor Iron Bound Curb has been for several years engaged in the business of laying Artificial Stone Pavements, and has put down large quantities of Cement Curbing, as at present used. THIS HAS ONE SERIOUS DEFECT, viz.: The liability to break or chip off at the outside edge or corner, from the impact of wheels of vehicles of all kinds trucks, coal carts, milk or express wagons; even wheelbarrows or bakers' carts will chip off pieces when rudely pushed against this edge, and destroy its symmetry.

The effort to overcome this objection has resulted in the present patented improvement, which is designated

THE ANCHOR ARTIFICIAL CURB.

ITS ADVANTAGES ARE

Greatly reduced cost as compared with Granite Curbing, which it will, in time, entirely supplant, as it is superior in appearance and finish.

It is provided on the outside edge with an iron plate, which strengthens as well as protects it from wear, and breaking from contact with cart or wagon wheels, or other causes of injury. This plate, being galvanized, does not discolor the face of the curb.

In addition to this, two bars of angle iron form the front and back of the bottom of the curb, making it **Iron Bound** on THREE corners, and tie rods are imbedded in the concrete for its entire length, giving it strength equal to granite, and making it absolutely **non-breakable.**

This curb is continuous throughout its entire length, and has no joints to separate and get out of position, as the short lengths now used of the ordinary stone invariably do, after a few years of use.

Although lighter, and containing less material than the heavy stones now used, it has a strong iron frame, resting on foundation pieces, which are buried deeper than the curbstones now in use, and provided with **Anchor Plates,** which make it immovable under any circumstances.

While it is an ornamental improvement to private dwellings, it is of great value in such places as the yards of breweries, and the vicinity of market-houses, warehouses, etc., where heavy wagons are continually backing up to receive or discharge their loads.

For railroad depots, wharves, piers and shipping docks, also driveways for bridges, it will prove of great benefit, and will outlast any other kind of Curbing that could be used.

The COMMERCIAL VALUE of the Anchor Iron-Bound Curb is in the fact that it can be laid at a much lower cost than Granite curbing and pay a profit of about 50 per cent.

It is superior in finish and appearance to Granite or Blue-stone, and fully its equal in strength. It has been laid for some months in Washington, and subjected almost daily to severe tests, and fully justifies all representations made regarding it.

The company adopting it in Washington is one of the oldest and best known in the United States, and companies in Baltimore and Philadelphia and other places are now being formed to adopt it in connection with other branches of the Paving business.

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GIBBS' G CEMENT

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IS THE VERY BEST MATERIAL FOR ALL PURPOSES ON ACCOUNT OF ABSOLUTE UNIFORMITY AND GREAT STRENGTH.

Testimonial

We have regularly used your Cement for over ten years, and have been so satisfied with the result of work done with it that we are this year placing with you the contract (30,000 barrels) for the whole of our requirements both at Stratford and Groby.

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Any person interested in anything that comes within the scope of this journal, who is not now a subscriber, we would like to have his name and address

WE CAN HELP HIM

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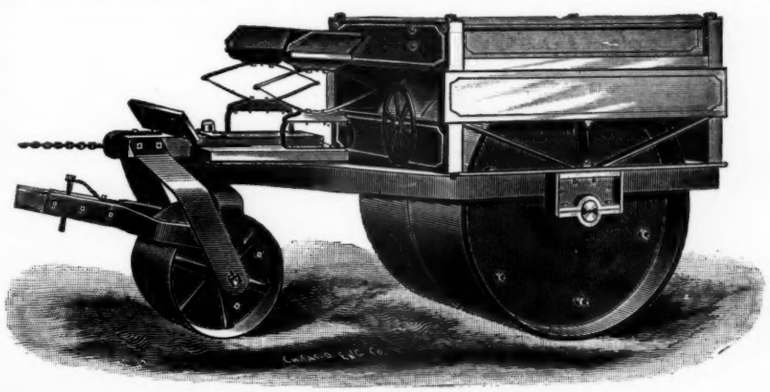

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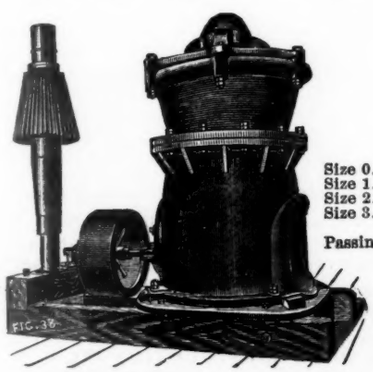

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It is used, principally, for heating paving pitch or tar.

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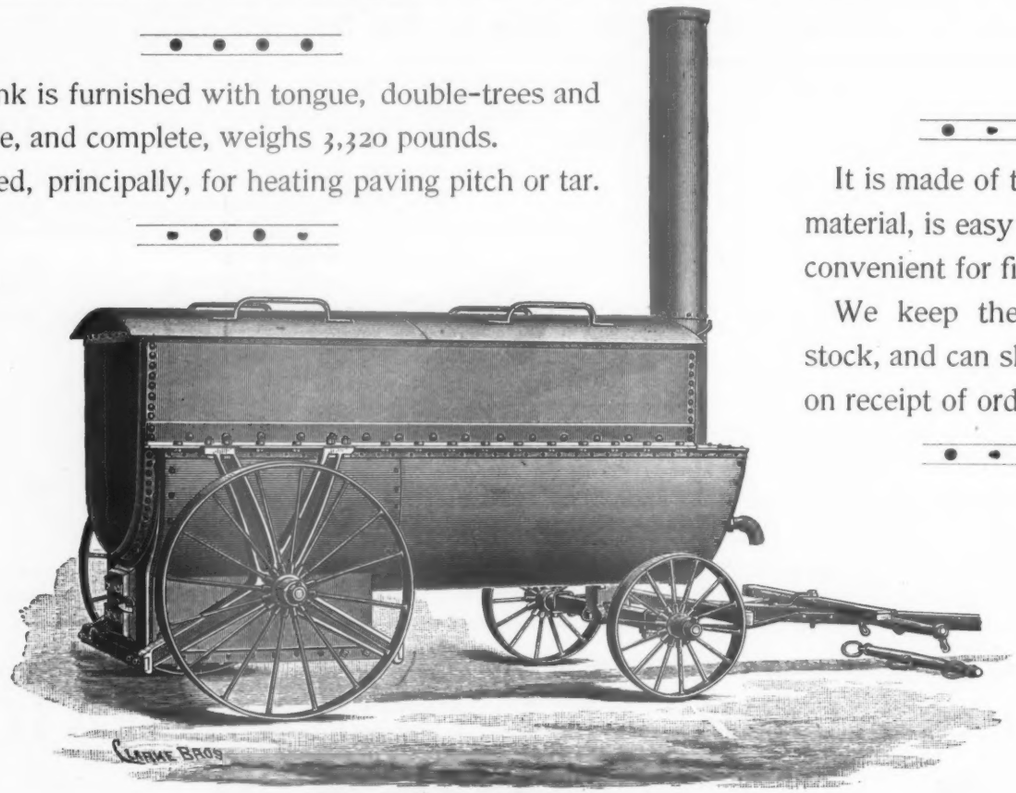

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By F. E. CUTTER, Manager Cincinnati Branch.

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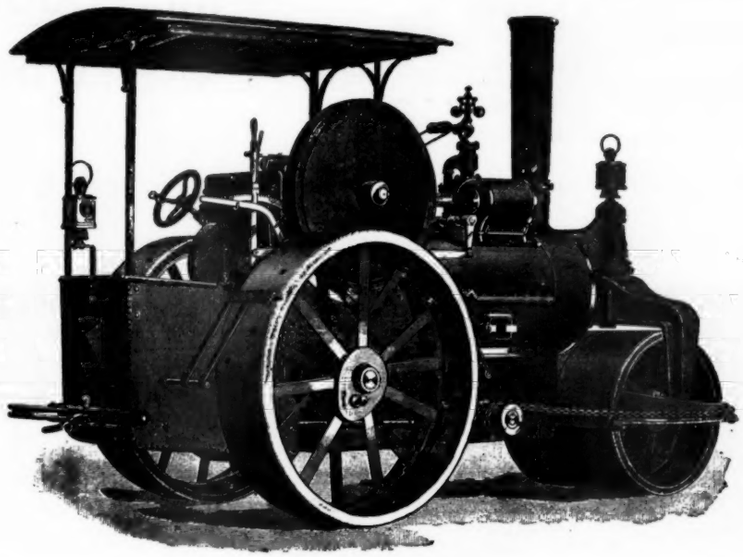

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WIDE FACE FLY WHEEL—To drive a belt.

COUNTERBALANCED CRANKSHAFT—Making engine run smoothly.

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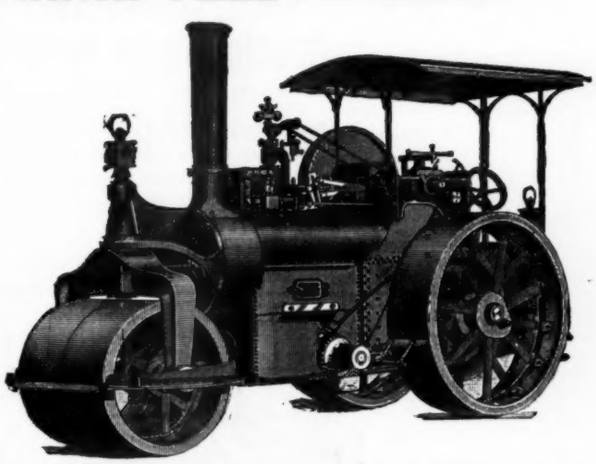
LARGE WATER TANKS—Making the machine more efficient in every way.



ABILITY TO ROLL CLOSE TO CURBING, ETC.—Thereby completely finishing the whole road.

FIRE BOX VERY DEEP—To avoid frequent firing and reducing smoke

DEEP ASHPAN—Fitted with doors on each side for Cleaning.

Handsome Illustrated Catalogue Sent Free on Application.

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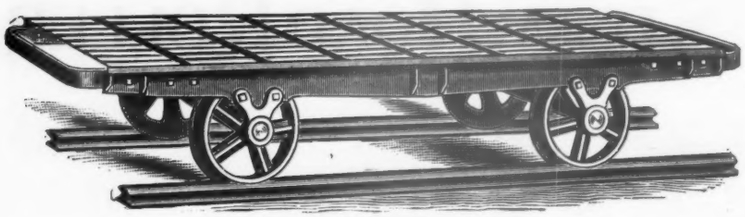

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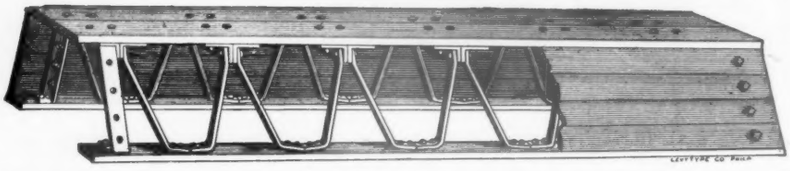

The owner of this new, cheap, portable **CULVERT BRIDGE,** wishes to lease territory, on royalty to responsible parties in different parts of the United States and Canada. This patent bridge is made of iron or steel and is adapted to all small streams, runs, branches, and low and marshy places where bridges, culverts or blind ditches are required in roads, lanes, streets, turnpikes, **RAILROADS, ETC.** Improved roads is the order of the day—why have bridges on the level with the roads? **USE THIS BRIDGE,** put it below the level, cover it over with the same kind of dressing as forms the road-bed and thus prevent jarring and wear and tear of vehicles, etc. This invention has been highly endorsed by Civil Engineers, Highway Commissioners, Road Supervisors and others.

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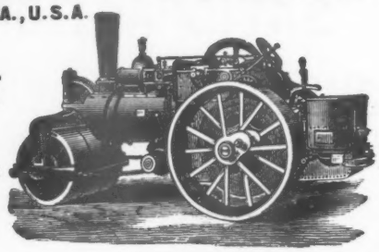
Double-Engine Road-Roller

Not only a Roller, but a Road-Machine.

NOT HOW CHEAP, BUT HOW GOOD.

NOW IN USE IN NEARLY ONE HUNDRED CITIES AND TOWNS IN THE UNITED STATES.



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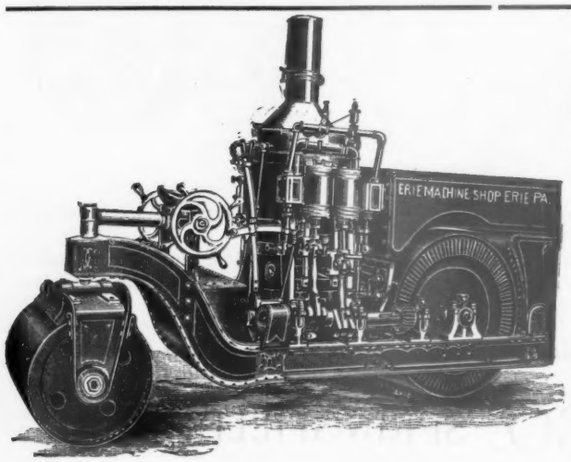

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MANUFACTURERS OF

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Corner Twelfth and State Streets,

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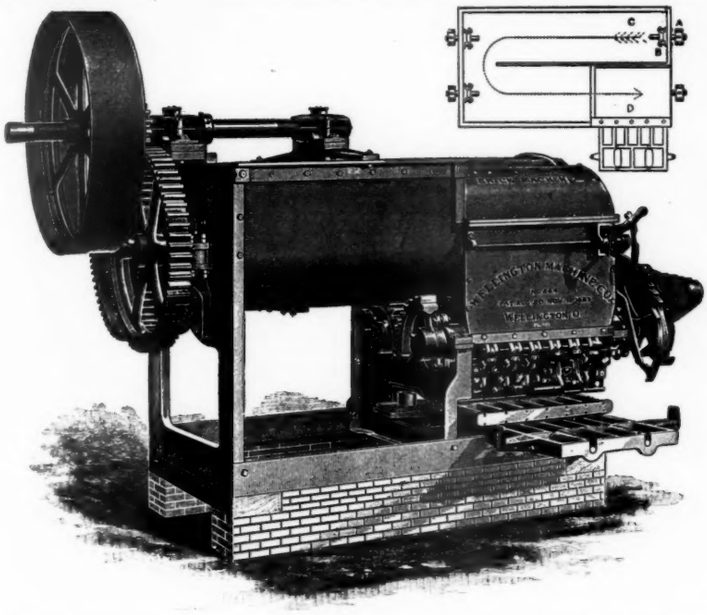
The principal Asphalt Paving Companies in the country are using these machines, which are pronounced to be the best in the market.



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A combined pug-mill and brick machine of the "soft-mud" class.

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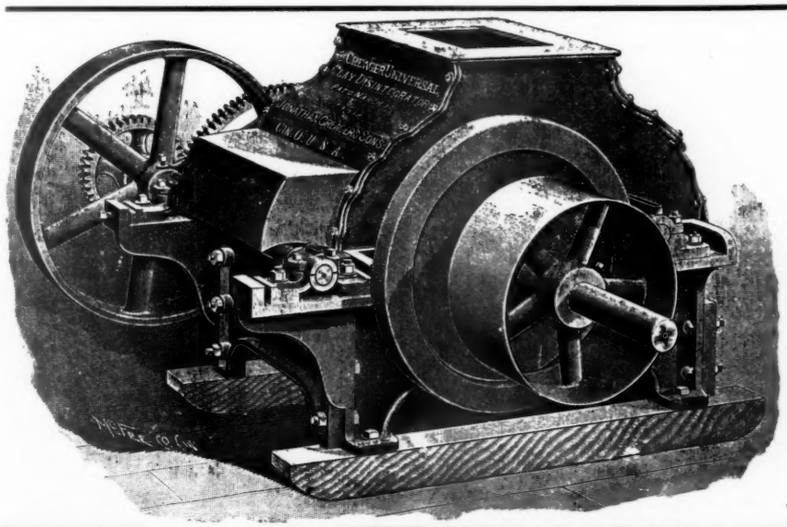

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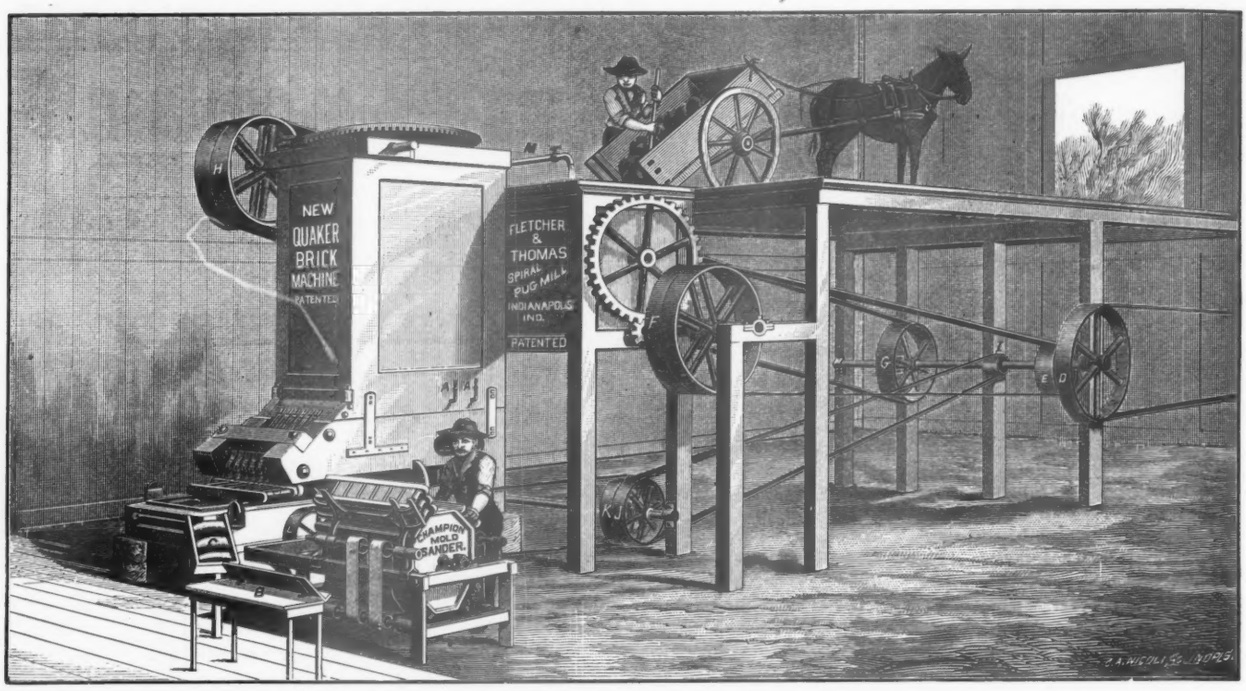

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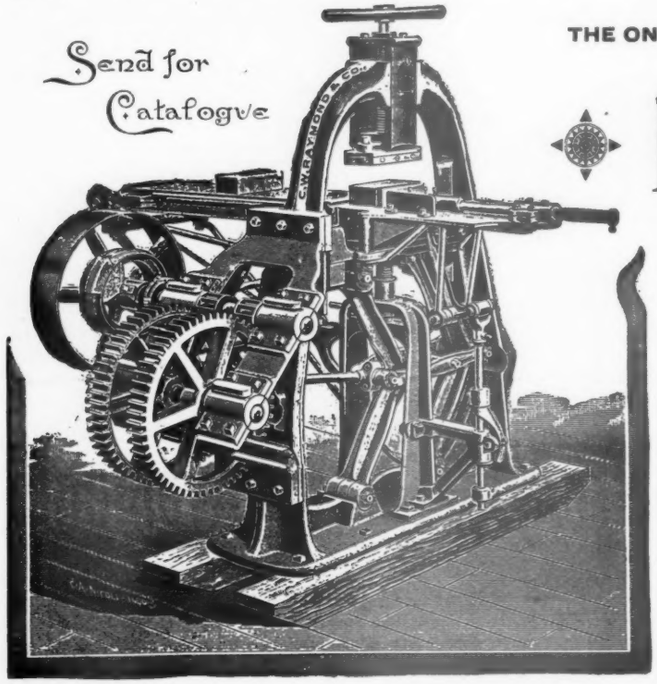

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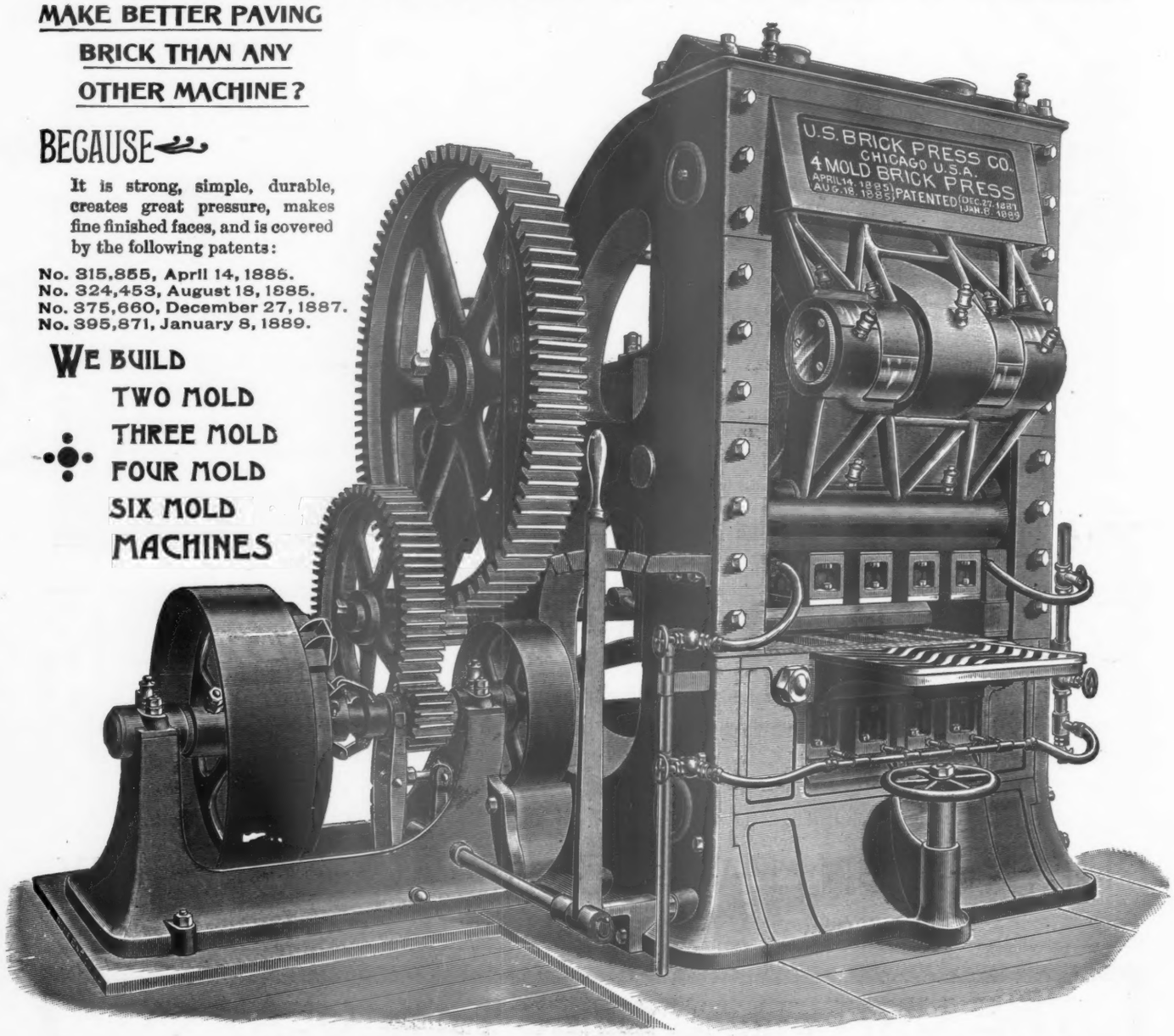

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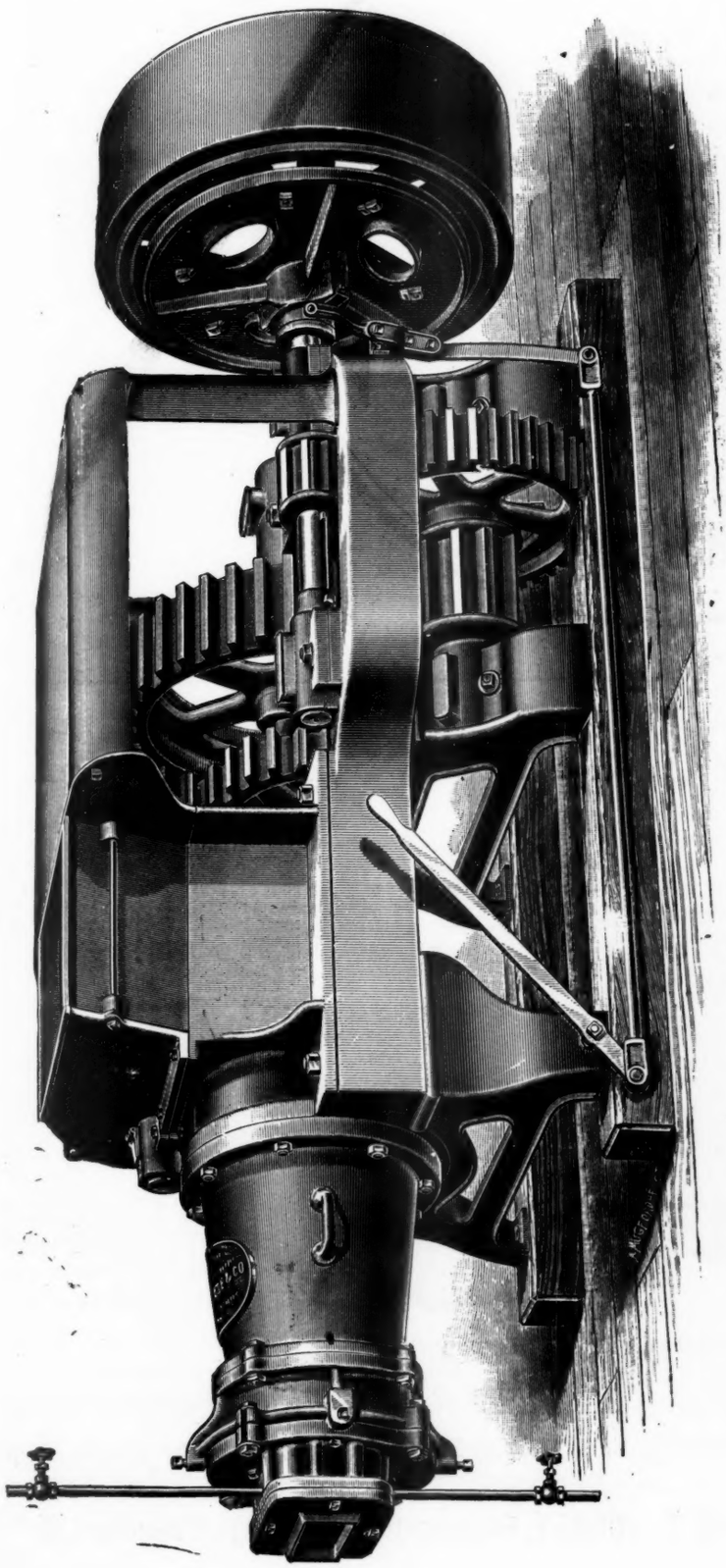

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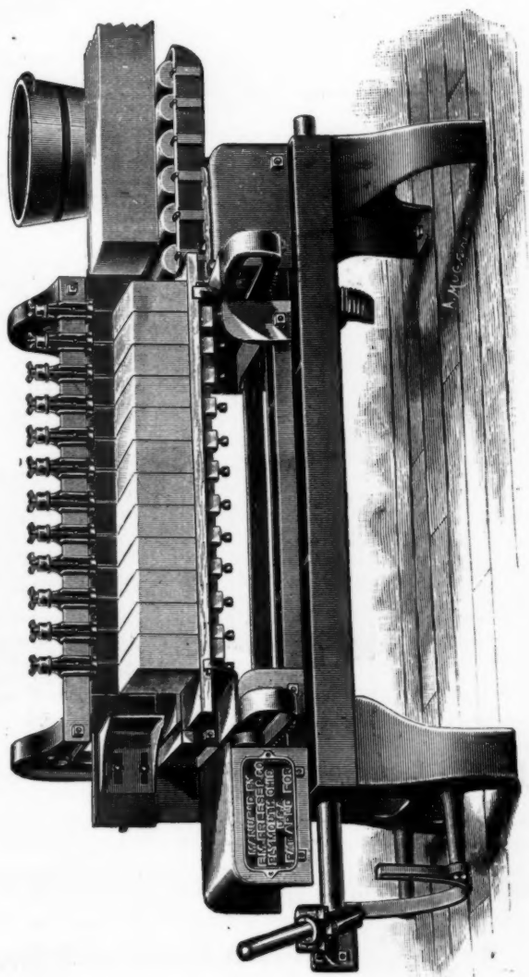

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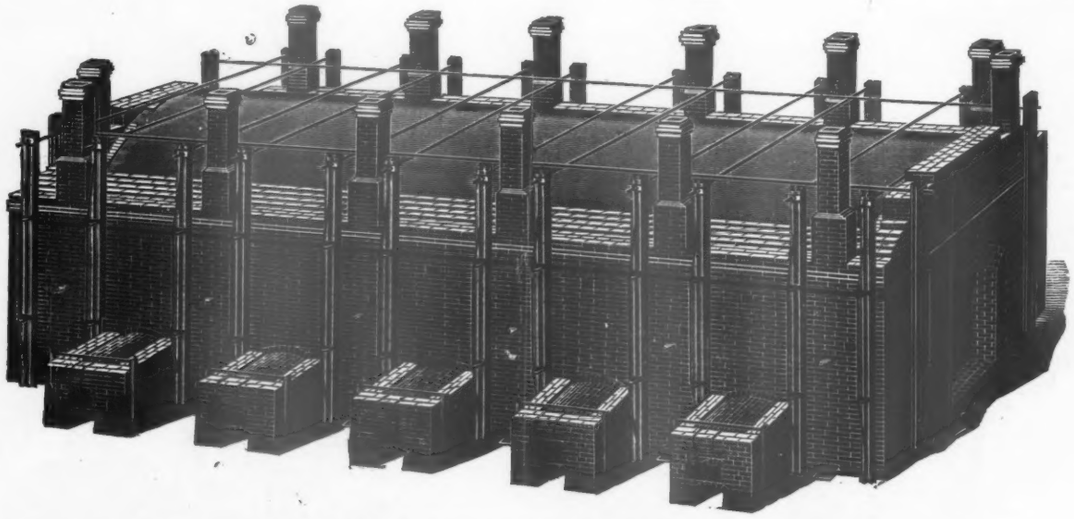

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